ROADS AND ROAD MAKING.*

What "I don't know about earthwork" would fill a very large volume. My name and the subject you wished me to discuss was introduced without my consent, and as my strength is limited and time fully occupied, all I can do at the present time is to give a few general hints on roads and road-making. My first observations and lessons on earth work carry me back forty years to the highways in the hilly portion of Ohio, south-west of Zanesville, where, as a boy 10 or 12 years of age, armed with a garden hoe, shovel or mattock, I saw the farmers and their sons marshalled under the road supervisor of the district, once annually, to work the roads, "make the rough places smooth and passable." The boys in the gang worked hard catching butterflies, wrestling, killing snakes and toting water. The men were discussing politics, instructing the supervisor how to do the work, and part of the time playing with the boys!

A gang of twenty to forty men and boys accomplished about as much effective work as one-fourth of the number should have done, if armed with suitable tools, and directed by a competent man who understood road-making. Judging from the condition of "the highways" in large sections of our State, this system of periodical holiday work is still maintained. It is a good system to develop cranks and loafers, and roads maintained under it are good enough for this class of men to travel. But a majority of us are better men and more deserving; we are in haste to reach the town and the market—hurry home again to resume some useful work, to economize time, and therefore demand a better system. Mr. Kent, of Adrian, gave us a good article on "Common Roads" at the last meeting, and the remedies suggested are excellent. "The repairs should," he says, "be the work of the season, a careful supervision being constantly kept over the whole system, and repairs made as often as they are required." Let us all labor to hasten the day when something like a system may be organized for the skillful and economical construction and maintainance of our common roads, the most indispensable and useful agents constructed by civilized man. The interests of all men are promoted by the construction of good roads, and to make them cheaply in the Saginaw Valley and other flat portions of the State where gravel and stone are wanting, and have to be transported long distances, I venture a few suggestions for your consideration and discussion. The old paths through the woods, made of corduroy across the swamps and all low wet lands, are practically impassable with loaded wagons for half the season. The few plank roads in the country, which were made from timber standing on the roadway and along its line, are nearly all worn out and abandoned. The timber for renewing them is consumed in many localities where they are most wanted, and you are practically without roads; they are *mud-ways*, breeding grounds for vile things, snakes, frogs, mosquitoes, foul weeds, malaria and death. A ride over them on a quiet Sabbath day in the months of April and May, what a pleasure! and what pleasant reflections and sayings are called forth. Concealed in the brush alongside of one of these "sloughs of despond," listen—you might perchance hear a Presbyterian deacon swear. What time have you, with your sweetheart beside you, to talk of love and flowers, a beautiful home, the comforts of home, and all that makes home pleasant and valuable? Who wants a home that you cannot approach with ease, comfort and dispatch? Nobody but savages, barbarous men and animals. You cannot build up good homes—at least they are not desirable, without good roads to approach them. Hence, good roads are the first things needful to advance the common interests of "a growing people." How shall we make them in the Saginaw Valley? I promised a suggestion.

In the first place I would select the leading road connecting a thriving country town with the city, along the line of which was located the largest and best equipped population to pay for the improvement. I would clear, grade, ditch, bridge, and thoroughly drain this road, making the cross section of it, of the best possible shape, to receive a heavy coat of gravel or broken stone, forming the base for a good turnpike or gravel road. Excuse me if I keep repeating the first requisite for all road making. Forty years' close observation of roads, has shown me clearly (and I think every keen, practical observer has noted the same fact), a drained road bed will stand a heavy traffic with slight and regular repairs, whereas, an undrained road is worthless, and does not deserve the name.

From June to October some undrained roads are passable for light traffice, if the dry weather lasts long enough to wear down the ridges, lumps, and hummocks which are always thrown up by moderate usage in soft, wet weather, and again in winter for about two months, if the ground should be frozen solid. After the hummocks are worn down and the ruts filled with snow and ice, they are fair sled roads for a brief season, as long as this remains.

When most wanted for general traffic, April to June and October to January, in this latitude, they are comparatively worthless. Now, gentlemen, drainage is the only cure, and while I would advocate ample side ditches, with uniform grades descending toward the natural water courses intersected, open ditches along the roadsides, in a flat country, are a miserable make-shift for permanent drains. They will aid and are necessary to carry off the water from heavy storms, and the melting snow and ice in the early spring, but they catch all light, floating matter. Animals in passing, mix it up, tramp over, obstruct and destroy them. To be efficient and serviceable in a flat country where the grade is slight, they should be mowed, raked and cleaned annually, and two or three annual cleanings, if well done, would pay for and place good tile drains in these same ditches on a lower plane. I would, therefore, place suitable tile drains two and a half or three feet below the bottom of the ditch, or four or five feet below the crown of the road-bed, and these tiles should be of sufficient capacity, when necessary and expedient, to take lateral drains from the adjacent fields of the farmer. Place in this system of tile drains, at proper intervals, silt basins, well constructed, so as to be cheaply maintained. Also wells at the outlets, with suitable grates and screens to protect them. Keep out of the drains everything but water, and I'll guarantee that to keep moving if you will provide the least show of descent. For small drains three inches fall to the hundred feet is ample: for large drains half this fall will do the work well.

We now have our road ready to receive the road metal. What shall it be? Stone, or gravel? We use both where they can be obtained. How shall we obtain them? Use the railroads already constructed, nearly all of which pass through, or near good gravel beds, to transport your material. Branch off from the railroad where your proposed highway intersects it; lay down a temporary track along the line of your graded road-bed, and distribute the stone and gravel for its formation just as you would ballast a newly constructed railroad track. Unload enough at one-fourth and one-half mile stations for contemplated repairs, and where cross-roads intersect your main line, deposit material enough to gravel a mile, or more, of lateral road. Grade and drain your lateral as suggested for the main line, and distribute the gravel over by the use of dump cars hauled by horses over a light and temporary rail track, in fact, a light railroad. When materials for the main line and laterals is distributed, begin at the extreme ends of the system, take up your railroad track and move "the plant" to a new field of operations. Without a little study and reflection this plan might appear expensive and impracticable, but I think it the only feasible and economical mode for securing good roads in flat districts of the State, where stone and gravel are wanting and the haul is great. Railroads are now equipped with steam excavators for loading cars. They unload by machinery, moving gravel and earth long distances for completing embankments where temporary trestles have been in use, and this work is done for eight to ten cents per cubic yard. Add to this a fair cost for transporting your gravel 20 to 50 miles. As the railroad companies are mutually interested with the public in any improvement that will cheapen production, add to the value of lands and multiply the population of the districts tributary to their roads, is it not fair to assume that counties and corporations can secure freights at about the actual cost of doing the work.

I had supposed this method of road-making was original with me—until Saturday last, when accidentally taking up the *Surveying and Building News* of December 15, 1883, I read as follows: "Improving Country Roads—Vigo and Park counties have set an excellent example to other counties in this State in the matter of grading their country roads. To William R. McKeen, President of the Vandalia Road, much of the credit for such improvement is due. He proposed to haul gravel from gravel banks on their road to the most convenient point for the farmers to unload it, at the actual cost of transportation. He was among the first to encourage such enterprise, and miles of road was thus improved; in other parts of the county, not accessible to this road, the gravelling of roads has been carried on liberally, and unquestionably Vigo county is in a excellent position in this respect. If the roads throughout the country are good the farmers can come to town at all seasons, regardless of the weather; but if the roads are bad they must remain at home until nature favors travel. If all over this state and Illinois taxpayers would cease to vote two per cent. taxes to new railroad enterprises, and vote aid to graveling their country roads, the value received for their tax would have been much more apparent. In the northen part of the State some of the townships have shown commendable zeal of late in this matter, and it is to be hoped that all will soon fall into line. The present law seems to be all that could be desired on the subject. Good roads are cheaper in the long run than bad ones, and if the farmers once had them they would wonder how in the world they existed so long without them. C. E. Henderson, General Manager of the Indiana, Bloomington & Western, is urging business men on their system in Illinois to take hold of this matter, and offers to haul gravel at actual cost of transportation, giving parties the privilege of loading and unloading the cars, and railroad men generally show a disposition to encourage all improvements of this character, as the farmers, the business men in town and the railroad will be mutually benefitted."—*Indianapolis Journal.*

Now, my friends, the work is already begun, supplying a narrow belt adjacent to the railroads, and my method of laying down the temporary railroad in flat districts completes the system and supplies all your wants.

As advertised on your programme, gentlemen, I have said very little about *earth-work* and am not prepared to do so on this occasion. My engagements have been such that I could not possibly take the necessary time to do the subject justice. I have seen great waste, and many expensive failures, where the axis of a road passes along steep hillsides, intersected by deep gulches, or ravines.

The important features in building embankments, like all other works where permanence and durability is sought for, is *the foundation.* Fit the surface to receive your bank, and drain it thoroughly; carry on the earth in layers of three to six feet, keeping flush with the slopes, and make these layers a little the highest on the outside, so that the earth will have a tendency to settle toward instead of from the centre of your bank; cart or haul over these layers continuously, so as to consolidate the mass as much as possible. This is an expensive method, but the only one I have ever tried that gave satisfaction in bad localities, where care was necessary.

*A paper read at the E. Saginaw Meeting of the Michigan Association of Surveyors and Engineers, by W. B. Sears, of East Saginaw, Chief Engineer of the Flint & Pere Marquette Railroad.

The Nicaragua Canal Project.

WASHINGTON, Feb. 15.—Some time ago a report was sent through the country by telegraph, that the Nicaragua Canal enterprise had been abandoned. This statement is denied by gentlemen who are interested in the Nicaragua Company. In the last Congress an effort was made to secure a national charter for the company, but it failed. The company was then incorporated under the laws of Colorado, and since that time, negotiations with prominent capitalists have been in progress looking to the construction of the canal by private subscription.

It is said there is a good prospect for the successful termination of these negotiations, and if the hopes of the promoters are realized, preliminary work on the Isthmus will be begun soon. The concession made the company by the Nicaraguan Government requires certain work to be done by the 1st of October. It is expected that this work will be duly performed, insuring the concession to the company for the future.

At the beginning of the present session, General Rosecrans introduced a bill in the House to incorporate the company and guarantee 3 per cent. interest upon its capital stock for a period of twenty years. This bill is slumbering in committee and there is no prospect of its passage by the House.

A gentleman interested in the enterprise said to-day, the company, even now, would much prefer that the United States should secure, by direct negotiations with the holders of the concession, the great national interests that are at stake. The concessionists, he says, have always been ready, and are now willing to practically give the Government control of the canal, but that up to the present time, no disposition has been shown by Congress to secure these advantages, and the holders of the concession cannot be blamed should they now proceed without reference to other than their private interests.

Representative Thompson of Ohio, on the 20th introduced a joint resolution asking Congress to appropriate $4,000,000 to construct a levee along the banks of the Ohio River at Cincinnati.

The New Root Wrought-Iron Sectional Boiler.

The sectional or water tube form of boilers have proven themselves safe, economical and durable steam generators; they have never yet been exploded, and upon competitive tests have always maintained a good record for evaporation and economy in fuel. But the trouble in the past, with this type of boiler, has arisen from the lack of adequate provision against the strains due unequal expansion and con traction, and the many vicissitudes to which boilers are exposed from careless or inefficient handling and generally hard usage.

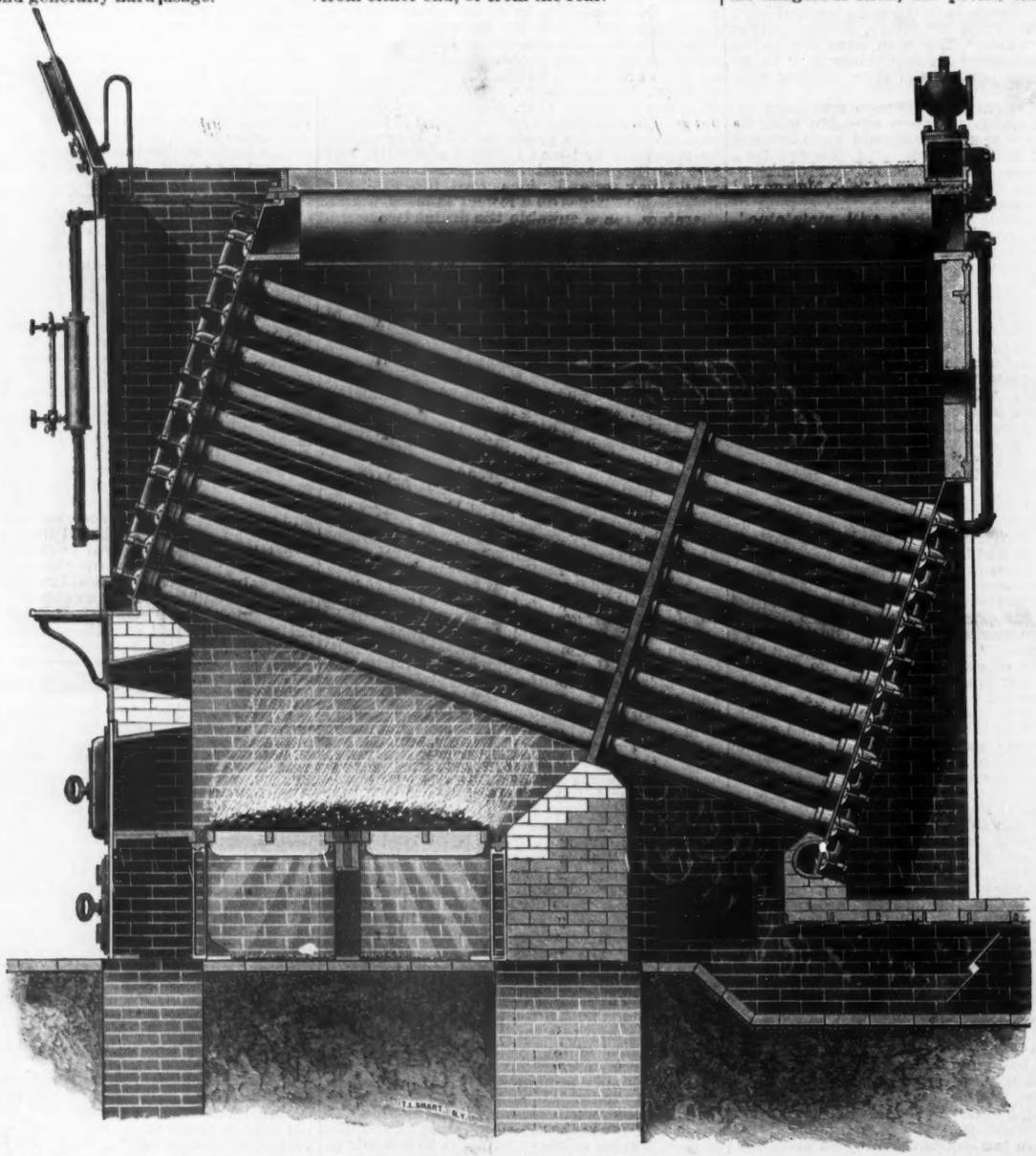


FIG. 1.—THE NEW ROOT WROUGHT IRON SECTIONAL BOILER

After years of experience and experiment, Mr. John B. Root, the original manufacturer of water tube boilers, has produced a perfected design, which answers fully the numerous important requirements of economy in fuel, ease of management, durability, accessibility for cleaning or repairs, rapidity of steam generation, and absolute safety from disastrous explosion.

This boiler is composed of a series of 4-inch lap-welded boiler tubes, arranged in pairs, and set at an angle of four inches in one foot of length of tube; these pairs vary in height and length according to the capacity to be developed. These 4-inch tubes are *expanded* at each end into cast-iron heads of special design and ample strength, and are connected by heavy cast-iron circular bends shown on Fig. 2. These bends are of the full capacity of the 4-in. tubes, and secured by bolts as shown on cut. Experience has shown that 12-feet lengths for the 4-in. tubes give better results than if longer. The tubes are arranged in pairs ten courses high, which constitute a section, and this section is connected at the rear end of the lowest course by a heavy cast-iron bend to the mud-drum, shown on Fig. 1. The mud-drum extends across the rear end of the boiler, with the ends projecting through the side walls; ample facilities are thus provided for cleaning the drum from either end, or from the rear.

Each section of ten pairs of 4-inch tubes is connected at the upper front end to a 14-inch lap-welded boiler tube twelve feet long, by means of an appropriate circulating bend. This large tube forms a steam and super-heating drum, from which perfectly dry steam is delivered. (Fig. 2).

Each section of ten pairs of 4 in. tubes, with its steam and super-heating drum, has a complete system of water circulation and steam generation, and constitutes within itself a boiler of twenty-five horse-power. Any increased power required is obtained by simply multiplying the sections with their component part. The entire boiler is supported upon a strongly braced iron frame work enclosed in brick masonry.

Among the advantages of this form of boiler, may be enumerated the following: The tubes being exposed to a *bursting* strain only, are much stronger than the same tubes in an ordinary boiler, where they are subjected to a *collapsing* strain as well; the tube resistance against the latter pressure is much less, about one to two, than against bursting. Each tube, containing but a small amount of water and steam, might be ruptured without dangerous results. It has all the advantages of the tubular boiler in heating surface, but is without the dangerous shell, the potent cause of disaster, and the constant source of expense in repairs. The Root design of tube head avoids the wear on the ends of the tubes. All parts of this boiler being uniform in length and size, will expand and contract equally, and any slight inequality of movement that might take place is provided for in the manner of attaching the parts. The boiler being built up of a number of like sections, the large boiler is as strong as the smallest, which is not the case in ordinary forms.

The space for the admixture of the air and the gases of the fuel are ample, extending the entire length and width of the boiler, between the rows of tubes. This peculiarily of construction is most advantageous in the economy of fuel consumed; and the currents of burn-

ing gases striking the heating surfaces of the tubes at almost right angles, as they do, is an obvious point of vantage. The ease with which the heating surface, grate surface, combustion room, etc., can be proportioned to suit the conditions under which the boiler is to be used, is another point in its favor.

An inspection of the illustration will show that the removal of scale or sediment is easily accomplished; and any damaged tube or part can be replaced without disturbing other portions of the boiler.

Year.	Date.	Feet.	In.	Year.	Date.	Feet.	In.
1832—	Feb. 18	64	3	1874—	Jan. 11	47	11
1847—	Dec. 17	63	7	1875—	Aug. 6	55	5
1858—	June 16	49	10	1876—	Jan. 20	51	9
1859—	Feb. 22	55	5	1877—	Jan. 20	58	9
1860—	April 16	49	2	1878—	Dec. 15	41	5
1861—	April 19	49	5	1879—	Dec. 27	42	9
1862—	Jan. 24	57	4	1880—	Feb. 17	53	2
1863—	March 12	42	9	1881—	Feb. 16	50	7
1864—	Dec. 23	45	1	1882—	Feb. 21	58	7
1865—	March 7	56	3	1883—	Feb. 15	66	4
1866—	Sept. 26	42	6	1884—	Feb. 7	61	10
1867—	March 14	55	8	1884—	Feb. 8	63	0
1868—	March 30	48	3	1884—	Feb. 9	64	1
1869—	April 2	48	9	1884—	Feb. 10	65	2¾
1870—	Jan. 19	55	3	1884—	Feb. 11	67	6¾
1871—	May 13	40	6	1884—	Feb. 12	68	10¾
1872—	April 13	41	6	1884—	Feb. 13	70	4
1873—	Dec. 18	44	5	1884—	Feb. 14	71	0¾

DISPOSAL OF SEWAGE.

At the Annual Meeting of the French Association for the advancement of Science, held at Rouen, M. Dehérain, in the Agronomy Section, took up the question of the disposal of sewage, and treated it from a somewhat novel point of view. He adduced a number of experiments to prove that arable land preserves the germs of ferments in a condition of vitality. M. Pasteur has observed that the *bacteria* which are the cause of carbon are thus preserved, and there is every reason to believe that the same is the case with the germs of other infectious or epidemic diseases.

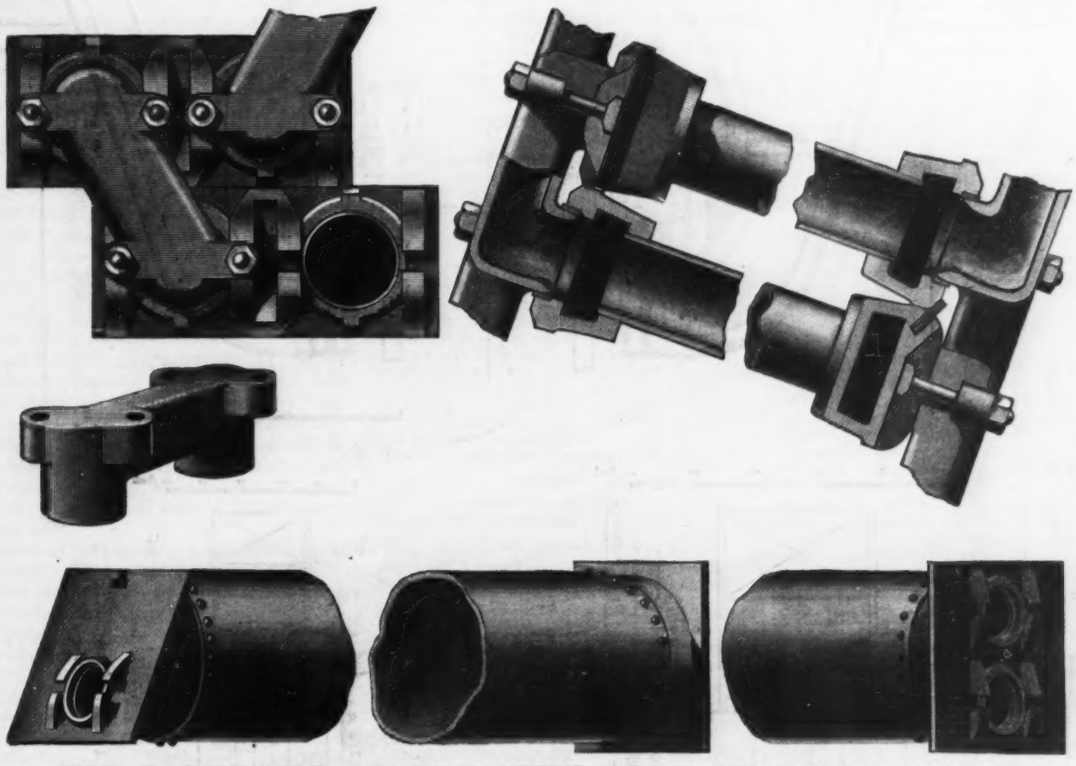


FIG. 2.—DETAILS OF THE NEW ROOT SECTIONAL BOILER

FLOOD NOTES.

Special Correspondence Cincinnati Enquirer.

LAWRENCEBURG, IND., FEB. 14.—At 4 o'clock to-day Operator Rolfe, who has patiently manipulated the wires at the McCullough drug store, on the only spot of dry ground in the entire city, placed on the bulletin board in the window a message saying: "The river is falling at Cincinnati." Instantly a hundred tongues proclaimed the glad news, and a thousand hearts were made lighter.

Much complaint is made by the people who own houses fronting the river against the steamboats that carelessly hug the Indiana shore in passing, and thus produce mighty waves that with each fluctuation carry destruction to the flooded houses. To-day the Andy Baum caused five dwelling houses belonging to Mr. Enos Barret to go down in the surging water, and Mr. Barrett, who had repeatedly notified the captain of the Baum to keep farther from shore, declares he will see if the Courts will not grant him some reparation for this wholesale damage done him.

Wilson Creek Bridge, between Aurora and Lawrenceburg, has yielded to the torrents that swept over it, and parted it from its foundation. Great destruction to other bridges on highways leading to the city is reported, and every public road will be impassible for months to come on account of broken bridges. From forty to fifty more houses followed in the wake of destruction yesterday, and it is feared that when the stubborn waters forsake their prey many more will be added to the list.

Lawrenceburg was in the midst of a sea of waters which filled the whole valley from the Kentucky hills to the high ground on the Ohio side. This area comprehended hundreds and thousands of acres. The whole town was occupied by the water, and it was impossible to distinguish the line of a single street by reason of upturned buildings and displaced houses.

The following table shows the highest stage of water at Cincinnati each year since 1858, and also in 1832 and 1847:

There is a remarkable coincidence between the time the present flood and the one of one year ago reached the highest point. Last year the river became stationary at 4 o'clock in the morning—February 15—just twenty hours later than in the present instance. The highest point reached last year was sixty-six feet four inches, which was two feet higher than the mark of 1832, the highest that had ever been known before. February 15 the river stood six feet and nine inches above the mark of 1832 and four feet nine inches above the mark of 1883. Another remarkable fact is that the floods of 1880, 1881, and 1882 attained their greatest height during the third week of February. From this it appears that there have been floods at the same time of the year for five successive years, and the last two have been the greatest since records began to be kept—ninety-five years ago.

THEORIES AS TO THE CAUSE OF THE FLOODS.—The philosophers are busy with speculations as to the cause of such remarkable floods. The first and most common suggestion was that it was due to the general destruction of the forests; then came the explanation that it was owing to the red sunsets. To-day an entirely new theory was obtained, and it is the most plausible one yet advanced. It is that, through the introduction of cheap tiling, the farmers have very generally provided drainage for their lands. The consequence, is, according to to-day's theory, that great quantities of water which was formerly absorbed by the lowlands now runs off almost as rapidly as that falling upon the hillsides. The fact remains, however that during the last fortnight there have been extraordinary rainfalls, which would have caused a great flood had the country remained in the condition it was a hundred years ago. That the proportions of the flood were increased by the destruction of the forests and the draining of the swamps and low farming lands is altogether probable. For the remarkable correspondence in the dates of the five floods of the last five years there is no explanation offered.

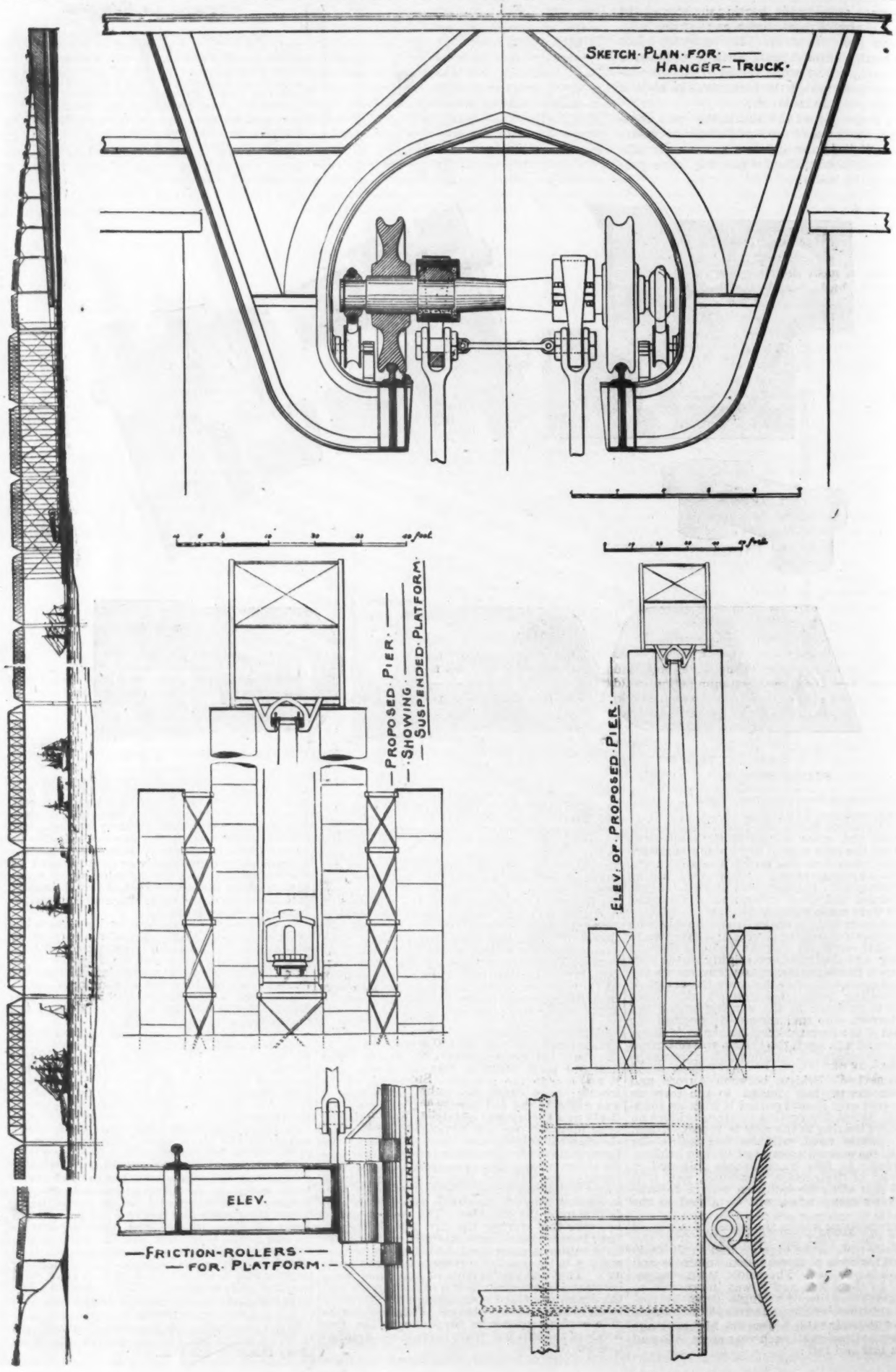
It therefore appears a somewhat dangerous proceeding to spread broadcast over the surface of the soil sewage matter which may contain infection of every kind, especially since it is well known that typhoid fever is propagated chiefly—some authorities say exclusiyely—by means of the excretions. He therefore strongly deprecated the sanitary system favored by the French Government, of allowing all waste matters from the houses to pass promiscuously into the sewers, and be subsequently distributed over sewage farms.

In the foreign cities where such a system has been adopted without bad results, the quantity of water at command for purposes of dilution is much greater than can be disposed of in Paris. The speaker advocated instead the manufacture of sulphate of ammonia out of sewage, the temperature to which the liquid is raised being sufficiently high to destroy the germs that are to be dreaded.

There is no doubt that this method would provide a much higher degree of security than the best system dependent only upon water; for the dilution of sewage merely scatters the germs of ferments, and does not destroy them, while there is no town in Europe that can claim to be free from typhoid fever and other zymotic diseases.

Careful studies have lately been made of the waters of the river Seine, with appalling results. M. P. Miquel found in one cubic centimetre of water taken from the Seine at Choisy 300 miscroscopic organisms; but in those specimens taken at Neuilly and Saint-Denis the numbers were 180,000 and 200,000 respectively, where the stream had received the pollution of Paris. At Pecq, further down, the organic matter had begun to subside, and the number was reduced to 150,800 per cubic centimetre. It is certainly time for the Parisians to do something to put a stop to the pollution of their river and they are quite aware of the fact themselves, but have not made up their minds what to do.

BILL empowering the Anderson County Court to levy a tax to build a jail, passed the Kentucky House on the 15th.


SKETCH PLAN FOR HANGER-TRUCK
PROPOSED PIER
SHOWING
SUSPENDED PLATFORM
ELEV. OF PROPOSED PIER
ELEV.
PIER-CYLINDER
FRICTION-ROLLERS
FOR PLATFORM

A PROJECT FOR BRIDGING THE HUDSON RIVER AT NEW YORK.

Direct railroad communication between the west bank of the Hudson and the City of New York, and through New York to the East, has long been one of the favorite schemes of our great transportation companies. The advantages are great and apparent, but the difficulties are as evident, and in the past have seemed practically insurmountable. The present conditions, as far as the Hudson are concerned, are a wide and deep river, with its surface crowded with shipping of every description, low-lying banks on either side, and a deep mud bottom, making pier building by ordinary methods, very difficult and very costly. A bridge, to meet the requirements of the case, must be high enough, not less than 150 feet above high water, to permit the free passage of ocean vessels, and be without a draw; such a bridge would be almost impossible in practice for railroad purposes owing to the long approaches from and to the low river banks.

Messrs. Andersen and Barr, in the plan submitted, believe they have practically solved the problem. The scheme includes high well braced piers of iron cylinders, an iron or steel truss or cantilever bridge, elevated 150 feet above high water mark, having attached to its bottom chord an appropriate system of track and hanging trucks, propelled by wire cables; and to have suspended from these trucks, a traveling platform sufficiently long to accommodate a full train, and this platform to be so regulated in elevation as to meet tracks on either side of the river at any desired height above the water level.

The crossing proposed is from Hoboken, at or near 18th street, as being located above the usual line of the traffic of ocean steam ships, and the point least liable to interfere with ordinary river navigation. The approach would be easy and convenient on the Jersey side, and on the New York bank communication could be established by tunnel or elevated track, with the existing lines of the N. Y. Central, and by them directly with the East.

The founding of the piers in the deep water and soft mud bottom found at this point would be an expensive operation by usual methods. The plan proposed in this case is similar to that so successfully carried out in the crossing of the Atchafalaya River, by the inventors of the present project (described in ENGINEERING NEWS of May 5, 1883). It embraces the sinking of four iron cylinders by the dredging process, a modification of the Milroy excavator, long successfully used in India and elsewhere. A depth of foundation can be secured in this way far beyond the possibilities of compressed air, and at a much less expense. These cylinders would be filled with concrete and grouped and braced somewhat after the plan shown in the illustration.

The widest channel openings are to be 500 feet each in clear span. To prevent lateral motion in the train platform, from wind pressure or other causes, this platform is designed to be long enough so that it is always between two sets of piers under any condition of position, say 1200 feet. By this arrangement four-fifths of the width of the river, or nearly 5000 feet would be open to navigation at all times. The propelling power should be under control from the moving platform.

This project is simply submitted as an apparently practical and comparatively inexpensive method of solving a difficult crossing problem, applicable to any navigable stream with low banks. The details have not yet been worked out. Whether such a low moving platform, traveling close to the water, could be made perfectly safe against collision under all conditions of fog, and darkness, and river traffic, is a question for careful consideration. But a proper system of signals, or an elevation raised above the ordinary tug or even river steamer, would do much toward eliminating these dangers, and still leave the scheme with many advantages of feasibility and cost over other projects.

It would seem to be very well adapted for the crossing of the lower Mississippi, which now, for nearly 1300 miles, cuts in two all railroad lines approaching its banks. It would apply to the long sought crossing of the Detroit River, or to that between New York and Long Island. Criticism is invited upon the scheme, its possibilities and its dangerous elements.

Sidewalks for Custom House and Post Office Cincinnati.

Synopsis of Bids Opened by Supervising Architect February 18, 1884.

GRANITE.

The Belknap and Dumesnil Stone Company, $17,200, 5 months.
Ph. W. Schneider & Co., $30,250, 6 months.
Alfred White, of Cincinnati, Ohio, and M. Gault & Son, of Baltimore, Md., $31,000 8 months.
Gill & McMahon, $37,761, 8 months.

INDIANA LIMESTONE.

Belknap & Dumesnil Stone Company, $14,750, 5 months; also, $15,950, 5 months.
Behan & McDonald, limestone, $11,316, 5 months; freestone, $8,400, 5 months.
Ashman & Glasgow, $11,700, 4 months.
P. Conkling & Co., $11,900, September 1, 1884.
Blatz & Krebs, $13,133, 90 working days.
David Hummel, $13,425, 2 months, bush hammered; $14,150, 2 months, pricked work; $14,825, 2 months, tool dressed.
Hallowell Granite Company, $13,747.

GRANOLITHIC.

L. S. Filbert, $8,970, 45 days.
H. L. Cranford, $9,100, 60 days.

ARTIFICIAL STONE.

Burns & Creecy, $5,168.16, 30 working days, crushed granite and Portland cement; George W. Cook, $5,490.
The Charles Kuhl Artificial Stone Company, $6,500, 5 weeks (granolithic).
No award has yet been made.

Public Buildings at Quincy, Ill.—Bids.

Indiana Oolitic Limestone Co., $37,997, Oolitic limestone, 450 days.
W. D. Collingwood, $42,346, Bedford, 10 months.
Blatz & Krebs, $50,572, Bedford, 225 days.
Larkworthy & Menke, $54,350, Bedford, Quincy steps.
Same firm, $63,580, Quincy, Bedford steps.
Scott Webber, $54,464, Bedford, September, 1884.
M. A. McGowan, $55,101, Quincy limestone, 20 months.
Same, $66,084, Illinois limestone, 20 months.
Smith, Sargent & Co., $55,737, Lemont, 15 months.
Smith, Sargent & Co., $60,131, Bedford, 15 months.
E. R. Brainard, $52,495, Indiana limestone, October, 1885.
E. R. Brainard, $58,608, Illinois limestone, October, 1885.
Hughes & Dugan, $63,690. Bedford or Warrinsby. 18 months.
James A. McGonigle, $67,635, Bedford Bluff, 18 months.
Sailes, Burnes & Co., $79,000, Bedford, 450 days.
Thomas Osborne, $83,000, 8 months.
The Young and Farrel Stone Co., $104,239, Lemont, December 1, 1884.
The Young and Farrel Stone Co., $109,230, Indiana limestone, December 1, 1884.
The award will be made as soon as the Supervising Architect has satisfied himself in regard to the ability of the lowest bidders to fulfill the contract.

Plumbing, Kansas City, Mo.

The Supervising Architect has authorized the superintendent of the custom house and post office building at Kansas City, Mo., to obtain proposals for plumbing, &c. Applications for schedules, etc., must be made to the Superintendent.

THE following certificates of incorporation were filed with the Secretary of State of Ohio on the 19th. The East End Sewer Company of New Lisbon, capital stock $600; the Sidney Edison Electric Illuminating Company of Sidney, capital stock $25,000.

SELECTED MISCELLANY.

THE new 10-versts-to-an-inch map of Russia, by M. Tillo, gives the following as the length of the chief rivers of the Empire: Volga, 2,108 miles, (the verst being taken as equal to 0.663 miles:) Ural, 1,480 miles; Dnieper, 1,329 miles; Don, 1120 miles; Kama, 1,117 miles; Petchora, 1,024 miles; and the Oka, 915 miles.

SOLIDIFICATION of nitrogen, according to an experiment by M. S. Wroblewski, by means of boiling oxygen, is effected at a temperature of 186° C. As yet he declines to explain the process by which he arrives at the result in detail; but he adds that when subjected to this intense degree of cold the nitrogen is clearly solidified and falls to the bottom of the vessel in which it is contained, like flakes of snow of a very remarkable size.

THE agricultural editor of the New York *Times* says that no doubt many farmers who are intending to underdrain their farms, would save money by employing an expert, at the first, to lay out the whole system and make a good beginning, and so avoid any possible mistake, which might cost $10 for every one paid for skilled advice. It should not be forgotten that when a drain is laid it is laid.

ST. LOUIS, Mo., Feb. 15.—The Mississippi River Improvement Commission is in session here arranging routine matters and making allotments of the $1,000,000 recently appropriated by Congress. So far they have allotted $100,000 for Plum Point Reach, the same amount for Lake Providence, $90,000 for Memphis, $50,000 for general service, and two small amounts for minor points.

To make straw and wood pulp, Mr. G. Archbold macerates either of the raw materials, after it has been cut into suitable pieces, in dilute milk of lime, and after 12 hours introduces it to a suitable digester, and saturates with sulphurous acid, the pressure amounting to from 58.8 to 73.5 pounds. After the lapse of two hours the material is so loosened up that after washing with water and further treatment with 3 per cent. of chloride of calcium under pressure, and ⅛ per cent. of aluminum sulphate dissolved in a little water, the stuff obtained, without any further operation, has the appearance of cotton and can, it is maintained, be employed for the manufacture of fine qualities of paper.

A VERDICT for $38,257 was rendered by a jury in the Superior Court, this city in favor of Messrs. Morton & Chesley and against Oliff F. Harrison, of Rutland, Vt. The plaintiffs are builders. They rebuilt for the defendant an edifice on 42d street near Seventh avenue, now known as the Percival, a bachelor-apartment house, and he not only refused to pay them but claimed $60,000 damages, on the ground that they had not done their work properly and in time. Their defense to the counter-claim was the assertion that whatever defects there were in the edifice, as well as the delay, were the results of following changes made in the plans by his agents.

GAS FROM SAWDUST.—An excellent use has been found for the enormous quantity of sawdust annually made in the lumber region of our country. From the Popular Science News for February, 1884, we learn that illuminating gas is made from it. Any kind of sawdust can be used; but that from resinous wood is preferable and affords a larger yield of gas. From twenty thousand to thirty thousand cubic feet of gas is obtained from a net ton of fuel. The wood-gas has the advantage of containing no sulphur, is more easily purified than coal-gas, and is said to be fully as good, while it is less expensive. The ordinary burners are used for wood gas. Mill owners can construct chemical works to make their own gas.

The advanced Association of Brooklyn held a meeting recently at which the members protested against the boiler laws of 1881, which pronounced an engineer guilty of manslaughter through whose malice, or ignorance, or neglect a boiler exploded with fatal results to human life, while the engineer's employer and proprietor of the defective boiler was only held liable to civil suit for damages. The members expressed surprise at the inactivity of the people of New York and Brooklyn, who often walked over volcanos in the shape of defective boilers beneath the side-walks, and declared that boilers that had been condemned by inspectors as unfit for use were sold to dealers who patched and caulked them, and insurance companies had been known to issue policies on such condemned boilers. The members then passed resolutions demanding that manufacturers of boilers should be compelled to place in a conspicuous part of the boiler a plate bearing the date of its construction; that any boiler that could not safely bear a steam pressure of 40 pounds to the square inch be condemned and ordered to be sold as old iron; that no dealer should sell or dispose of a boiler unless it be previously examined and pronounced safe by inspectors; that no person under 21 years of age be given a certificate as engineer: that a penalty of $2,000 be imposed upon any employer who should require his engineer to perform other duties than were required in his certificate; that all classes of engineers be subjected to a rigid examination as to their qualifications, and that licenses or certificates be only given to citizens of the United States.

Engineering News

AND

AMERICAN CONTRACT JOURNAL.

Tribune Building, - - - New York City.

THE ENGINEERING NEWS PUBLISHING CO. PROPRIETOR.

PUBLISHED EVERY SATURDAY.

CONDUCTED BY

GEO. H. FROST and D. McN. STAUFFER.

TERMS OF SUBSCRIPTION:

$4.00.....PER YEAR TO U. S. AND CANADA.
$5.00..... " " " FOREIGN COUNTRIES.
Make all drafts, cheques and money orders payable to ENGINEERING NEWS PUBLISHING CO.

ENGINEERING NEWS.

CLUBBING ARRANGEMENTS 1884.

In order to accommodate such of our subscribers as may wish to subscribe for other periodicals, we offer the following terms: We will send to any address ENGINEERING NEWS at regular subscription price, $4.00, and the following at the additional prices given:

	Net. Price.	Reg. Price.
Atlantic Monthly	$3.25	$4.00
Century Magazine	3.55	4.00
Harper's Magazine	3.25	4.00
Harper's Weekly	3.25	4.00
Harper's Bazar	3.25	4.00
Harper's Young People (weekly)	1.25	1.50
Popular Science Monthly	4.25	5.00
St. Nicholas Magazine	2.85	3.00
Journal of the Franklin Institute	4.00	5.00
North American Review	4.00	5.00
Our Continent	3.25	4.00

PREMIUMS.

In order to stimulate present subscribers to increase our list, we offer the following inducements: For every new subscription sent us we will pay **One Dollar Cash.** By a little effort each subscriber can get his own subscription free at the same time that he assists in quadrupling our list.

TABLE OF CONTENTS.

	PAGE
Roads and Road Making	85
The Nicaruaga Canal Project	85
The New Boot Wrought-Iron Sectional Boiler	86
Flood Notes	87
Disposal of Sewage	87
A Project for Bridging the Hudson River at N. Y.	89
Sidewalks for Custom House and Post Office, Cincinnati	89
Selected Miscellany	89
The American Institute of Mining Engineers	90
Transactions of the American Society of Civil Engineers	90
A Contractor Held for Ransom	90
The New Orleans Elevated Railway	90
Chlorate of Potash as an Explosive	90
Cincinnati Board of Public Works	91
Bay City, Mich., Water-Works	92
Personals	91
New Publications	91
Correspondence	92, 93
History and Statistics of American Water-Works	98
Water	94, 95
News of the Week	95
Iron and Metal Markets	96

As typical of the inventive age in which we live, and as marking the vast advance over the methods of only a generation past, we note the successful completion of a book-perfecting printing machine, the invention of H. P. Feister, Mechanical Engineer, of Phila., Pa.

This truly wonderful machine is nearly as large as a passenger locomotive, weighs almost as much, and cost $20,000 to build. It cuts from an endless roll of paper, sheets of the size required for the work in hand, prints one side, transfers it to a second cylinder and prints the other side; prints the cover, in from one to four colors, fastens the sheets together folded, bound covered and trimmed, and finally counts the books, a bell ringing when 5,000 are finished. All of this is done automatically, human hands being only required to start the webb of paper into the machine. It will turn out a complete 32 page almanac at the rate of 100 per minute; this requires the cutting off of 48,000 sheets of paper, and 88,000 type impressions per hour, not including in the count the cover.

The makers have already sold this first machine, and we understand that Mr. Feister sails shortly for Europe, where another machine is already contracted for in France.

The American Institute of Mining Engineers.

Volume XI of the Transactions of the above society has been received, embracing the period between May. 1882 and Feb. 1883.

According to the list appended, there are now belonging to the Institute 3 Honorary Members, 1138 Members, 154 Associate and 50 Foreign Members.

Forty-one papers upon matter of interest in mining and to mining engineers, and full reports of the annual meeting in Colorado are presented as a record of the year's work.

Transactions of the American Society of Civil Engineers.

The November number of the Transactions contains the following papers: "The Cost of Steam Power," Charles E. Emery, with discussion; "The Shubenacadie Canal," Edward H. Keating; "The Nasmyth Pile Driver," Don J. Whittemore; "Vibration or the effect of passing trains on Iron Bridges, Masonry and other Structures," James L. Randolph, and discussion; and "On an Economical and Efficient Railroad Bridge Floor," W. Howard White.

The Proceedings contain the minutes of the Society meetings of November 7 and 21, and of the Board of Direction of October 31 and November 7.

A Contractor Held for Ransom.

The Italian laborers on the B. & O. Phila. extension, having in memory a favorite metho of their own sunny Italy, lately captured and held for ransom, J. Harrigan, a contractor indebted to them for work done.

This is a little contingency, in the employ of Italian labor, not usually discounted by the average employer. Under similar conditions, the old-time rail-roader would simply have gone upon a general spree, : nd if anything had been captured it would have been the most accessible groggery where they could keep their spirits up by pouring spirits down. With money gone and the tap exhausted they would have tramped it to the next work.

While in the case mentioned, the prisoner was rescued before the threatened hanging was carried out, the warning should not pass unheeded. Hereafter, when Italians are in question, Mr. Contractor should either pay promptly, or, if circumstances or economical motives prompt him to do otherwise, he should make himself scarce in the neighborhood of his anxious employés.

The New Orleans Elevated Railway.

From a descriptive pamphlet issued by the company, we learn that the purpose of this organization is to provide a complete system of terminal facilities, for passengers and freight, for all railroads now entering New Orleans.

As all these roads must get to the river, and, in fact, have free access to all parts of the river front; an elevated railway system is the only one possible which will leave the streets and levees of the city unobstructed by the laying of rails.

The company has by its franchise right of way for its length over city property, and the cost of construction does not thus include any real estate.

The general scheme proposes a structure of plate girders supported upon iron posts, not nearer to each other than 40 ft.; there will be two main tracks, supplemented, for the greater part of the way, by two side tracks, with a clear headway beneath of 18 ft. wherever surface rails are crossed. The general grade will be nearly level, and the minimum radius for curvation will be 1,000 feet.

Connections are to be made with the six principal railroads, now entering the city, by long inclines; differing little in construction from other parts of the road. The depots for freight are to be provided with hydraulic lifts.

The company was chartered by the State of Louisiana on April 7, 1883, with a capital stock of $5,000,000. The President is F. de Funiak, of Louisville, Ky.; and B. M. Harrod and Henry B. Richardson are the Chief Engineers.

The pamphlet mentioned contains a map of the proposed route, which follows the river front from Louisiana Ave., up-stream, to Independence Street, down stream, with a central station on Canal Street near the Post Office. Plans are also shown of the depots and incline connections to be built.

Chlorate of Potash, as an Explosive.

The Society of Mineral Industry, at its December meeting, held at Saint-Etienne (France) had submitted to it the report of a committee, appointed to examine into a new explosive, the invention of M. Michalowski.

As the result of a series of experiments, the committee reported, in substance, as follows:

According to the wording of the patent the composition of the powder is:

Chlorate of Potash	50
Bioxide of Manganese	5
Organic matter, finely pulverized	45
	100

The organic matter which forms the combustible element of the explosive mass, should be wood sawdust, powdered tan, bran, etc. The committee tested its power in the quarry of Quarte-Aygues, the rock being a massive and very hard mica schist. Holes were drilled under identical conditions, and charged with equal weights of dynamite No 1 and the "Miner's powder," as the inventor calls it; the effects produced were about equal. But the committee state that while the dynamite threw out the rock in greater quantity and to a greater distance, the useful effect, in shaking up the rock, was greatest with the new powder; they attribute this to the slower rate of combustion of the latter.

To obtain equal effects with ordinary mining powder, double the weight of the new explosive had to be used; and it was further noticed that with equal weights, the new powder and ordinary powder produced about the same quantity of smoke.

In addition to these experiments, the committee submitted the powder for trial to three contractors, two of whom were working in a gallery in sand stone, the third in an open-air quarry. These men all agreed that it had double the power of ordinary mining powder, and that the smoke produced was about the same.

The inventor recommends that the powder be rammed in the hole, so that its density might be increased, and consequently the height in the hole be decreased. The two first contractors mentioned above, reported that they obtained better results by *not* ramming it; they perhaps feared, with some show of reason, that ramming would bring about an explosion. The worker in the open quarry appreciated the advantages of compressing the powder.

The committee concluded their report as follows:

1. That the "miners' powder" was manufactured without danger, and in the most simple manner; it was only required to add bran to a solution of chlorate of potash and leave it dry.

2. That its transportation should be attended with no difficulties, for it was only after some effort that particles were exploded upon an anvil.

3. That the force of the powder is practically equal to dynamite No. 1.

4. That the gases produced by its explosion are probably much less injurious than those emanating from other explosives.

5. That this powder can be firmly compressed by rammers, provided no sparks are evolved without danger.

The editor of the *Genie Civil*, in commenting upon this report, remarks, that without contesting the result of these experiments, apparently made with care and by competent parties, he believes the conclusions should be accepted with some reservation, as being somewhat too absolute.

Chlorate of potash and its compounds were among the very first ingredients investigated by the searchers after a bursting powder; it was first employed, and then abandoned without just cause. But in view of the grave accidents that have already occurred from its manipulation, it seems rash to affirm that its manufacture and transport is attended with no danger.

The want of density, even when compressed, is a serious objection, since it necessitates an increase either in depth or diameter of the hole, a costly operation in hard rock.

The *Genie Civil* also thinks that the committee blundered in using dynamite No. 1 in making comparative tests in mica schist or sand-stone rock; that dynamite No. 3 or 4, of less cost, produces in these rocks the same effect ascribed to the new powder. It hopes that new and further experiments may be made so that engineers may have a more just and complete report upon this new product.

Cincinnati Board of Public Works.

We have received from H. J. Stanley, Chf. Eng. of the above board, the report for the year ending Dec. 31, 1883.

The cost of the city improvement for 1883, was $468,910.54; $244,733.59 having been expended for the construction and repair of sewers alone. Nine and one-quarter miles of sewers were built in the last five months of the year, but of the twenty-four square miles of territory included in the present sewerage system, but two square miles are sewered. The board recommended heavier appropriations than are now available, for the more speedy construction of this much needed improvement.

The removal of the city pumping station is again strongly urged, as its present position interferes with the sewage disposal for five miles of river front, and it is also subjected to danger from extreme floods.

In referring to the high water of February, 1883, the official figures given for the rise above city datum, or low water mark, were, at Youngbluth Ave., near Eastern Ave., 65.86 ft., and at the Front Street pumping works, 66.33 ft. The tendency had been to regard the floods of 1832 and 1847 as unequaled, and never to be approximated even in the future again, 64 ft. being the high water of the years named. As a consequence of this delusion, many streets leading to the surburbs west of Mill Creek have been constructed below the flood of 1832; these were all rendered impassible by the high water of 1883. (The high water of February 14, 1884, was 71 ft. 0¾). The board therefore recommended, that, while avoiding extravagant expenditure to meet any possible flood, the level prescribed by general grade resolution of March 15, 1854, be insisted upon in future construction, viz.: an elevation of 62.50 ft. above city datum.

The report contains a handsome map showing the area submerged by the floods of 1883, in Cincinnati and its vicinity. Another map also shows the present and proposed sewerage system of the city.

The present area of Cincinnati is 24.09 miles; of this, 539 acres are devoted to seven parks. There are 244 miles of improved streets and alleys, and 208 miles yet unimproved.

There are now 63.71 miles of sewers built, 25 miles are constructed of brick or stone, the remainder is pipe sewer.

The American Society of Civil Engineers.

At the meeting of February 6, ballots for membership were received, and business transacted.

A paper by Hamilton Smith, Jr., on "Water Power with High Pressure," was read and discussed. The usual collation was served after adjournment.

At the meeting of February 20, a paper on "Structural Steel," by Edward B. Dorsey, was read by the Secretary, and discussed at some length by W. H. Paine, Theo. Cooper, M. N. Forney, Francis Collingwood, and others. While some doubt was expressed as to the reliability and adaptability of "mild" steel to bridge construction under the present conditions of manufacture and tests, it was ackowledged that upon railways, steel had practically driven iron rails from the market, it was universally used in the construction of locomotive fire-boxes and for many other parts of these machines, and in the shape of tires was rapidly supplanting the cast-iron car wheel.

BAY CITY, MICH., WATER-WORKS.

We are indebted to E. L. Dunbar, Superintendent of the above works for the annual report for 1883.

Bay City now claims a population of 25,000; and the old pumping machinery, after eleven years of constant service, has proven inadequate to meet the present demands. The superintendent therefor recommends the immediate purchase of a set of pumping engines of not less than 4,000,000 gals. daily capacity, of the horizontal, duplex compound type.

In the forcing and distributing mains of these works, the wooden Wyckoff pipe is almost exclusively used, with satisfactory results. The total lengths and sizes in place are as follows:

Supply Mains.	*Miles.*	*Feet.*
30-in. stave-pipe, from the bay	4	66
18-in. " " " " river		386
	4	452

	16-in.	12-in.	10-in.	8-in.	6-in.	4-in.	3-in.	Total.
Iron	1,410	4,883	8,458	1,938	958	665		18,323
Wyckoff			8,128	13,208	51,782	19,125	319	92,563
Totals	1,410	4,883	16,586	15,146	52,750	19,790	319	110,886

	Miles.	*Feet.*
Total iron mains	3	2,483
Total Wyckoff mains	17	2,803
Total	21	6

There are 297 valves and 150 fire hydrants in the system.

Water meters are recommended as the only practical system for checking waste. Notwithstanding an increase of about ten per cent in the consumers, and an increase of $1,000 in the water rates, the total quantity of water pumped last year was 1,700,000 gallons less than in 1882, before meters were introduced; 37 meters are now in use, of the rotary and crown patterns. The service connections number 1,127.

The pumping expenses for 1883, including salaries, fuel, oil, supplies and repairs was $7,-551.65. The total quantity of water pumped in the year, as indicated by pump revolutions, was 773,942,702 gallons, delivered for ordinary domestic use at a pressure of 40 lbs. per sq. inch. and for fire purposes at 70 lbs.

The net cost per million gallons pumped was	$9.77
Cost per million gallons raised 100 feet	9.07
Cost of fuel per million gallons pumped	4.12
Cost of fuel per million gallons raised 100 feet	3.82

The total receipts for the year from water rates was $18,386.32. The 56,080,827 gallons of metered water yielded a revenue of 7⅓ cents per 1,000 gallons. Deducting the public supply for fire, street-watering, etc., the water furnished consumers would return a revenue of about 3¼ cents per 1,000 gallons.

In stating the amount of work done at Panama, in last week's issue, the figures were incorrectly given. According to the latest official statement, the total work done upon the canal, in November, was 444,700 cubic yards; and the total excavation to Dec. 1, 1883, was 2,722,700 cubic yards.

PERSONAL.

HORACE H. MOSES is the newly elected Superintendent of Sewers, of Boston, Mass.

WILLIAM H. BROWN, chief engineer of the Pennsylvania Railroad is still in Europe and is not recovering his health so rapidly as his friends desire, and it is stated that he will probably resign, and J. T. Richards, acting chief engineer, will be made his successor.

HUGH J. JEWETT is a director in twenty railroad companies, Samuel Sloan in twenty-three, Jay Gould in twenty-four, George B. Roberts in twenty-six, Augustus Schell in twenty-eight, Sidney Dillon in thirty, and Frederick L. Ames in fifty-two.

GEN. HUGH H. BAXTER, once a well-known contractor and speculator, died at his residence, 588 Fifth Ave., this city, on the 17th, at the age of 66. He built the Rutland & Bennington, and Toledo & Wabash Railroads.

He succeeded Mr. Keep as President of the New York Central Railroad, and was an intimate friend and confidential adviser of Commodore Vanderbilt until the latter's death.

NEW PUBLICATIONS.

"PICTURESQUE B. & O. HISTORICAL AND DESCRIPTIVE," by J. G. Pangborn.

Under the above title, the Baltimore & Ohio R. R. Co. has issued a book with over 150 pages of historical and descriptive matter, that in some respects eclipses the like publications of rival roads. It is filled with very finely executed wood cuts of scenery along the line, from the designs of such well-known artists as Thomas Moran, I. O. Davidson, W. L. Sheppard, W. Hamilton Gibson and Sol Eytinge. The engravers of these designs are men who are all well known in their particular line of art; and they have done exquisite justice to the original sketches.

The text is readable and interesting; and while it describes and emphasises the many localities, either grand or beautiful by reason of Nature's handiwork, or made so by man for his comfort, convenience or profit, the book looks like anything but what it is—a very neat and tasteful advertisement for one of our great railroad trunk lines.

"A NEW SYSTEM OF LAYING OUT RAILWAY TURN-OUTS INSTANTLY, BY INSPECTION FROM TABLES." By Jacob M. Clark. D. Van Nostrand, publisher.

This is another among the many labor-saving devices of this time-economizing age. Mr. Clark, in basing his treatment of turn-outs, locates these upon a curve tangent to the main-track, at a point not far from the heel of the switch; by so doing, he avoids the complications of other published solutions, when the turn-out is regarded as tangent to the *switched* or deflected rail, and reduces the exact solution of all turn-outs to three cases, of simple method. The same is true of *cross-overs*.

In this little work, the author first treats his subject mathematically, each case under its own head, and involving simply the resolution of right-angled triangles, with two parts known, or oblique triangles with three given sides. Tables then follow, ranging in degree of curvature or divergence from 1° to 50°, accompanied by rules for use, to find by inspection the proper frog-angle and the distance for a turn-out of given radius, or degree of curvature.

CORRESPONDENCE.

THE RAND AIR-COMPRESSOR.

Special Correspondence Engineering News.

OFFICE OF THE CHAMPION IRON COMPANY. }
MARQUETTE, L. S., MICH., Jan. 26, 1884. }

N. W. HORTON, ESQ.,
Supt. Rand Drill Co.,
New York City.

Dear Sir:—We have had at the Champion Mine, one of your 10x16 duplex air-compressors for about five years, and one of your 20x48 duplex compressors, for over a year. They have both given the most perfect satisfaction, never getting out of order, or requiring the expenditure of a dollar in repairs, though the smaller machine—owing to press of work in the river has been driven at the rate of one hundred and thirty revolutions per minute.

We have taken no cards from the small machine lately, but the cards from the 20x48 are as nearly theoretical, as it is possible for any engines to give. We are satisfied that yours are decidedly the best machines made. Very truly yours

A. KIDDER, AGT.

TREATISE ON BRIDGES.

Special Correspondence Engineering News.

STAYNER, ONT., Feb. 16, 1884.

EDITOR ENGINEERING NEWS.—Will you be good enough to send me the names of a few works on bridge building suitable for local work under the direction of a county engineer.

What I should like to consult in it would be a general form of specifications for small wood or iron structures, and the improved ideas in bridge building. I do not want a very expensive or voluminous work but one convenient for reference. Respectfully

H. W. S.
P. L. & D. L. SURVEYOR.

[The only book we can recomend to fill above requirements is Boller's Iron Highway Bridges which was written for just the purpose expressed by our correspondent. Price $2.50.—ED. ENG. NEWS].

REGULATION OF WESTERN RIVERS.

Special Correspondence Engineering News.

NEW YORK, Feb. 14, 1884.

EDITOR ENGINEERING NEWS.—In view of the appalling and annual loss of life and property in the Ohio Valley from floods, would it not be better for the Govt. to make thorough surveys of the principal tributaries of the Ohio River, ascertaining the fall, flow and volume of such streams as the Miami, Allegheny, Youghiogheny, Kanawha, and Big Sandy Rivers? With such data and frequent cross-sections, plans might be devised and estimates formed upon which we could determine the sites and cost of a series of stout dams, by which to regulate the flow of water going into the Ohio, I propose these dams to be filled with adjustable waste-weirs and locks to serve ordinary or flood water, and to hold back in great reservoir in the upper country, the surplus flood that now goes below and carries death and destruction in its course. As against original cost of such extended improvements, I call attention to the annual loss from present condition of things. Against the flooding of cheap lands on the tributaries, look at the millions of property destroyed in the cities and towns below. The condemning of the cheap lands in the upper waters would be a trifle, and the benefits accruing to the same territory would more than offset loss of river bottom. Would not such improvement open up to traffic by slack water navigation the inaccessible solitudes of W. Virginia, Pennsylvania and E. Kentucky? Would not there be established great water-power on all these streams for various enterprises? Would not the transportation facilities thus rendered to the miners, farmers, and lumbermen fully repay them for the sacrifice of the few acres of river bottom? Would not the Davis Island Dam below Pittsburg still preserve to that important city the depth of water she expects?

I would like to hear the views on this subject of those of the profession more familiar with those streams than I am, and especially Col. Wm. E. Merrill, U. S. Engineer, Cincinnati, O., as to the feasibility of my suggestions.

If such plans were formd to control the floods in the Ohio, why could it not be applied to the Mississippi's tributaries and the great "Father of Waters" himself be held in subjection?

Touching on this subject, the Army Engineers have invariably reported adversely, or at least declare them impracticable for the lower Mississippi. As to the Red River, Gen. Warren says: "There are no reliable sites for reservoirs sufficiently large to produce the desired effect. The question of absolute practicability could only be decided by a series of extensive and elaborate surveys."

One high authority says: "The only practicable plan and least expensive would be to stop cutting off the forests." This means that clearing and cultivation expedites the washing process and consequent filling up of water courses in alluvial districts.

As to the tributaries of the upper Ohio, a very different condition of things exists. Broad streams through high lands where immense quantities of water may be stored. Is not so desirable an end justified by a survey, even if it should prove impracticable? T. L. M.

GELATINE SENSITIVE PAPER.

MARE ISLAND U. S. STR. HAULER, Feb. 11, 1884.

EDITOR ENGINEERING NEWS.—Will you kindly inform me as to where I can obtain the "improved gelatine bromide of silver paper," mentioned in the NEWS of Dec. 1. By so doing you will oblige

Yours respectfully.
A. D. S.

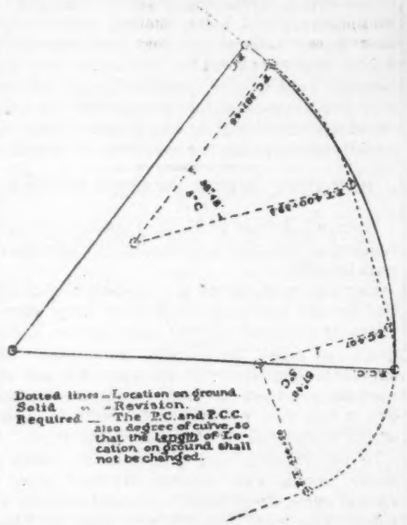
[E. & H. T. Anthony, 501 Broadway, N. Y. are the parties to address].

PROBLEM IN COMPOUND CURVES.

Special Correspondence Engineering News.

SOMERSET, PA., Feb. 7, 1884.

EDITOR ENGINEERING NEWS.—The following problem having occured in our railroad work here and eliciting some discussion, I send it to you hoping a solution.


P.C.
P.C.C.
P.C.C.
Dotted lines = Location on ground.
Solid " = Revision.
Required. — The P.C. and P.C.C. also degree of curve, so that the length of Location on ground shall not be changed.

It was required the P. C., P. C. C. and degree of a curve which would start from a given tangent and compound with another curve already on the ground, and give the same length of alignment as the previous location consisting of two curves and a tangent *i. e.* to displace this location without changing the stationing.

Enclosed you will please find sketch of problem which will explain itself. "A SUBSCRIBER."

INDICATED BRIDGE TESTS.

Special Correspondence Engineering News.

MANCHESTER, N. H., Feb. 16, 1884.

EDITOR ENGINEERING NEWS:—Since renewed interest has been awakened in indicator tests of bridges by the recently published description of "an ingenious apparatus brought out by a Mr. Biadego, for registering the deflection of a girder under dead and moving loads," and a discussion thereon, in *Mechanics* of February 2, 1884, referring to indicated tests made by Prof. Robinson, in Ohio, in September, 1881, I will add another item to the history of this method of tests, by quoting from a report made to the officers of the New London Northern Railroad, of the test of a new bridge on their line.

The structure in question is a trapezoidal wrought-iron, single track bridge of 145' 3" span erected in the summer of 1875, to replace a Howe truss of wood, at the crossing over Yantic River, at the "Falls," in Norwich, Conn. As trains frequently passed the bridge, it was inconvenient to make the dead load test mentioned in the contract, but instead, three locomotive engines, weighing respectively 48, 50, and 53 tons, were used, at rest and in motion.

The report, after describing the shop test of the bridge materials, says, in relation to the tests of strength and rigidity: "The deflections and oscillations were taken by self-recording pencils attached by short laths to the iron transverse beams of the bridge beneath truss posts, and recorded on smooth blocks which were attached to staging posts under the bridge. The deflections, counting posts from the south end of the bridge, were, as measured from the cards:

	Post 4, West Truss.	Post 4, East Truss.	Post 6, West Truss.	Post 6, East Truss.	Post 8, East Truss.
	in.	in.	in.	in.	in.
1 Engine (53 tons) at rest in center	.37	.380	.450	.44	.290
2 " 103 " " "	.56	.555	.583	.64	.485
3 " 151 " covering the bridge.	.59	.590	.750	.73	.525

Three coupled engines running 25 miles per hour.

Post 6 ..... .79 in.
Horizontal oscillation, each side of neutral point, with three coupled engines crossing at 25 miles per hour, Post 6 ..... .25 in.
Permanent set after weight test ..... .58 in.
Additional set after speed test ..... .005 in.

The bridge has eleven panels, the distance of above mentioned posts from center of bridge being as follows: Post 6, one-half panel; post 8, one and one-half panels; and post 4, two and one-half panels.

Several trains had passed through the complete bridge previous to the test.

Three diagrams from the speed test are copied herein full-size, by pantograph." Rate 25 miles per hour, three coupled engines.

Post 4. Post 8. Post 6.

Continuing, the report gives estimates of deflections with several additional loads, up to the contract test strain of 3,000 pounds per lineal foot, assuming the weight as abscissas and the diagram deflections as ordinates. At the test, which was made August 20, 1875, five diagrams were taken simultaneously in each experiment.

The *speed* tests were taken, first, with one engine crossing several times at different velocities, then similarly with 2 coupled engines, and then with 3 coupled engines. Diagrams at post 6 were taken under the observation of the writer, and the remaining diagrams were observed by assistants.

A description of the "Falls Bridge" with references to the indicator tests herein mentioned, was published in the next succeeding report of the Railroad Commissioners of the State of Connecticut.

In 1876, Prof. Fletcher, of the Chandler Scientific School, instructed his pupils in making indicator tests of bridges near Hanover, N. H., similar to those made on the N. L. N. Railroad.

The Manchester, N. H., daily papers published, in August, 1881, a synopsis of a report made by the City Government of Manchester, of tests of a city bridge, consisting of three wrought-iron double-decked highway spans of 137 feet each, one span of 63' 9" and 465' 9" of wrought-iron trestles. The tests in this last case were made with loads at rest and in motion. Some of the live load tests were very severe, as they were made with heavy loads moving at various rates, up to the equivalent of several steam fire engines following each other closely, with horses at full gallop. The writer included seventeen *fac-simile* diagrams in the last report.

Respectfully,
J. T. FANNING, C. E.

RESERVOIRS IN LIMESTONE COUNTRIES.

Written for Engineering News:

BY E. P. FULLER, C. E.

The building of reservoirs to hold any considerable depth of water, in regions underlaid by limestone formations, contains an element of danger little appreciated by those who have had no experience of their failure.

At present there is an almost universal demand among the larger towns and cities of East Tennessee and Kentucky for a supply of water, and few of them are in a position to build and own their works. Under such conditions the works if built must be by private enterprise, and several undertakings of such character will doubtless be commenced during the present year. The character of the country, and the general topography of most of the towns and their suburbs renders the reservoir system one of almost universal adoption, and we can predict with a reasonable degree of certainty, that many storage reservoirs will soon be built in these States. Thinking that the experience I have just undergone, while engineer of the Knoxville Water Co., may be of interest to engineers and contractors engaged in such work, I give a description of the building, failure and repairs of the reservoirs at Knoxville, Tennessee.

This reservoir, at Knoxville, is built upon the summit of a hill 234 feet above low water in the Tennessee River. The pumping station is situated upon the river bank 2,500 feet from the reservoir, and the water is forced through a 14 inch pipe by two of the M. T. Davidson steam pumps of a capacity of three million gallons in twenty-four hours. The elevation of the reservoir above the thickly built business portions of the city is from 100 to 110 feet, and the distribution system consists at present of about 9¼ miles of pipe. The net storage capacity of the reservoir is 3,200,000 gallons, and to hold this amount a depth of 18 feet is required in the basins.

The works were commenced in the summer of 1882, and carried on during the fall and winter, being finished and ready for operation on May 28, 1883. During the excavation of the basins almost no vibration

was discovered in the soil upon which they were built, the entire cutting being in a tough tenacious red clay, which had a slight admixture of sand and considerable quantities of small rock. The excavated material was used in the banks, and selected portions of it were used to puddle the sides and bottom. The reservoir is built in two sections, being divided by a division wall 10 feet in width at top and with slopes of one to one, the slopes of the outside banks being 1½ to 1. The slopes are first covered by 15 inches of puddle on top of which is laid 4 inches of road metal. On this road metal cement is placed, and the brick lining set into it, the final effect being almost equal to 4in. of concrete on the bank. The bottom was also puddled and covered with road metal. At no part of the excavation was solid rock of any description met with, or in boulders larger than a man's head, while boring developed the fact that at no part of the bottom was there less than 20 feet of solid clay above the rock.

The water was pumped into the reservoir for the first time on May 28. Until June 2, all was well. The settling and absorption of water by the puddle and lining was less than had been expected, and although careful observations were made, very little loss of water could be detected. At seven o'clock on June 2, the first break occured in the north division. Visible first as a swirl on the surface, it rapidly increased until in ten or fifteen months from the time it was first discovered over one million gallons of water had been emptied from the reservoir, carrying with it nearly 300 cubic yards of earth, puddle and broken rock. The opening was irregular in shape and approximately about 20 feet square. No signs of damage to the south reservoir was visible at this time, and water was pumped into it to a depth of 11½ feet. Three days after this depth had been reached, the south division broke, this time near the toe of the outer wall, and as in the case of the north division the water passed out in from ten to fifteen minutes. This hole was much larger than the one in the north division, and eventually necessitated the replacing of nearly 1,000 yards of earth. This second accident left us with no alternative but to pump direct upon the mains to supply the city with water, and owing to the difficulty of regulating the pressure the pumps were run as slowly as possible and the water was allowed to wash over the top of the influent pipe into the south division. To everyone's surprise the water, instead of settling through the mass of loose earth that filled the hole to within 10 feet of the bottom, remained in the reservoir and gradually filled it to a depth of 7 feet. The loose earth that fell in after the great mass of water passed out seemed to have filled the hole and effectually puddled it.

This depth allowed the use of the south division, and work was at once commenced on the first break. On removing the loose earth and other debris from the hole, a ledge of rock was found at a depth of about 23 feet below the surface of the bottom. The ledge was of soft, shaly limestone, seamed and pierced in every direction with crevices from 6 inches to a couple of feet in width. Most of these were tightly filled with puddle and broken rock washed from the surface. At this portion of the break no opening was found of sufficient size to pass a large quantity of water in the time taken to empty the reservoir, and it was soon evident that the greater portion of the water had passed beneath the division wall diagonally across the corner of the south division. As the break extended some 10 feet into the toe of the middle wall, it was necessary to fill behind us before cutting into the bank, the work being already 43 feet below the surface.

The crevices and openings in the rock were filled with concrete, and a firm, level, water-tight foundation was made, completely covering the whole ledge where visible. The broken and cracked edges were cut off and placed on top of this, and the layers of puddle were started. The loose earth was then removed from the side of the bank, the wall shored up and a cutting soon disclosed the real channel taken by the water.

Extending from the toe of the division wall diagonally across the bank toward the other reservoir, was a cavern 50 feet in length, 13 feet high and varying in width from 15 to 7 or 8 feet. The top was level with the top of the ledge first found, and the bottom 13 feet below, formed by the upturned edges of the limestone strata. This bottom was 60 feet below the crest of the bank, or 54½ feet below the natural ground, the fill at that point being only 5½ feet. The bottom and one side was rock, solid, and of the same character as the ledge without. The top was simply an arch of clay, and considerable quantities of loose earth had evidently recently fallen from it, a portion of which had been swept out by the rush of water. 50 feet in from the toe of the embankment the cavern decreased in size to about 6 feet square, and at this point was nearly filled by loose earth. Even at this distance pieces of concrete, brick and puddle were found tightly wedged together, and the opening seemed here to tend downward at an angle of about 45°. This being entirely outside of the reservoir, it was considered unnecessary to excavate farther, and the work of filling was at once commenced.

The loose earth was removed from the bottom to be used for puddle, and a wall of rubble masonry laid in cement was built at the extremity of the cave, extending across and completely closing it. The bottom, where the rock was fissured and broken, was covered with concrete, and all cracks and crevices effectually stopped. Against the wall the layers of puddle were commenced, inclining at an angle of somewhat less than 45°, and brought steadily out to the face of the opening. All loose or cracked earth was taken from the top and sides and channels were cut to make more binding the joint of the puddle and the natural earth. On reaching the face of the opening the layers of puddle were gradually brought to a horizontal position, and the hole was entirely filled with puddle clay. The sides were cut into steps, and as the work approached the surface it was spread over an area several times as large as the original break.

The broken stone and brick lining being replaced, water was at once turned into this reservoir, and the south division was emptied preparatory to commencing work on the large hole in that side. On pumping the water from the depression, the hole was found to be filled with loose earth to within 10 feet of the bottom. The area of the break at this depth was, approximately, 40 feet square, and from views obtained of it, while the water was passing out, it was known to decrease in size as the depth increased. It was in fact a funnel, smallest at its lowest extremity, and spreading outward toward the top of the embankment. Nine feet of mud and very soft earth was removed from the bottom of this hole, and soundings were made at intervals of 10 and 15 feet over the whole area affected by the break. This was found to include nearly two-thirds of the bottom. Over this area cracks were found running from the larger hole in various directions; and a considerable area had settled from 1½ to 2 feet, this being immediately around the break through which the water passed. The borings made, failed to discover rock at a depth of 43 feet, and it was finally decided to fill the hole from the depth at present attained. The sides were cut off wherever cracked and broken, and the whole area affected, was excavated to a depth of 10 feet. Immediately around the breaks the cut was 19 feet, the earth being found solid and unyielding, a few feet below the reservoir bottom. Over the opening, which it will be remembered, was already filled with loosely packed earth; a sheet of concrete was placed 4 feet in thickness completely covering it, and extending at the edges 10 feet in every direction on the solid ground. The break was thus completely covered, and sealed by the sheet of concrete, and the layers of puddle were started from a firm foundation 19 feet below the bottom of the reservoir. Over the entire area excavated, the earth was replaced as puddle, the sides of the excavation being cut in steps and a close water-tight joint made with natural ground. The puddle was continued above the bottom to the top of the embankment replacing the portion that had fallen out, and the lining was replaced as at first.

No trouble has been experienced with any portion of the reservoir worked over, but a break of similar character to the one just described, occurred in the north division some three months after water had been placed in it. This last break was in the corner most remote from the first, and it did not differ materially from it. It was repaired in the same manner, with the single exception that in place of concrete at the bottom large rock blasted from the quarry, were used. These were dumped from the top of the bank on the natural ledge that was plainly visible. Loose clay cut from the broken edges, was thrown in, and alternate layers of heavy stone and earth were brought up to within 8 feet of the surface. A constant stream of water was kept running upon this as the work proceeded, and the whole mass settled firmly upon the solid ledge. At 8 feet below the bottom of the reservoir, the layers of puddle were commenced, and the hole filled as in the case of the former break. The rock in this place was found at a depth of 28 feet below the grade of the reservoir bottom, and was broken and seamed in every direction, leaving abundant opening for the water to pass out. It was now decided to place a layer of concrete over the entire surface of the bottom, to stop, if possible, all settling of the water through the clay, and re-enforce any weak spot that might exist in the area as yet undisturbed. In the north division the toe of the bank was cut out, and the sheet of concrete extended 2½ feet under the walls on all sides, the triangular space above the horizontal layer being also replaced by concrete. In the south reservoir this was not considered necessary, and the concrete was placed simply on the bottom, and over the toe of the slope. Eighteen inches of concrete was placed over the entire surface of both bottoms, covering the work already done as well as the area as yet untouched. This is the last work done on the reservoirs, and since its completion no trouble has been experienced. The settling appears to have been completely stopped; careful observations failing to discover any loss of water when either basin was cut off from the pipes, and the water allowed to stand. There is now little danger of further trouble of like character, and the reservoirs may be considered in perfect working order. No signs of weakness in the banks have ever been observed, the entire trouble being at the bottom at an average depth of 8 to 10 feet below the natural surface of the ground.

The peculiar phenomena above described have to my knowledge no parallel in the history of water-works. Reservoirs have failed through weakness in their banks, they have developed leaks in both banks and bottom, but accidents of a like character and extent have been rare. The reservoir of the Louisville Water Co., is an instance somewhat resembling it, but then the banks were much smaller, and the rock was found at a depth of but a few feet below the natural surface of the ground. No quantity of earth at all approximating to 500 cubic yards was ever washed from the interior of the reservoir into caverns unknown and unexpected beneath its bottom. In the case of the Knoxville reservoir the solid rock was at no part of the basin less than 20 feet below the grade of the finished bottom, this 20 feet being clay apparently firm and unyielding. That it did yield, we have abundant evidence, as also that the rock beneath was honey-combed with fissures and caverns. These openings could not be found with a boring tool, no part of the uncovered ledge showing any vertical opening or fissure that could possibly be indicated by a tool cutting earth alone. The mouths of these fissures were covered simply by earth, and the soil immediately about them was probably of a more sandy open texture than the general mass examined and bored into. The puddle on the bottom being leaky, the water reached the natural earth, which instead of affording the resistance reckoned upon, allowed it to filter downward and gradually wash out a cavity from the earth immediately above the opening. This done it was only a question of the ability of the clay arch to sustain the weight of water, its strength being constantly diminished by the percolation of the water and the washing away of its mass.

Such an occurence is difficult to guard against, owing to the trouble of carefully examining the bed of rock below, but it is also one that may happen to any reservoir built over the ordinary limestone formation, and the presence of such danger introduces a very appreciable element of cost in any estimate on projected reservoirs to be built in that portion of the country.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.; M. INST. C. E.

(*Continued from page 71*)

DXCII—ARCHBALD, PA.

Archbald, Pa., in lat. 41° 30' N. long. 75° 35' W. is on Laurel run, a mountain stream in Lackawana county. It was settled in 1845 and incorporated in 1875.

Water-works were built by a private company in 1875 after plans of O. D. Sheppard, taking the supply from Laurel run, the water of which was impounded by a timber dam, forming a storage reservoir 250 feet above the town. A 10-inch stone-ware pipe conveyed the water 2,000 feet. This pipe gave way after a few years and in 1883 1,500 feet of it was replaced by cast-iron pipe. Distribution is by 3 miles of cast-iron pipe of 10 to 3 inches diameter, with 8 fire hydrants, 1 gate and 100 taps. Service pipes are of wrought-iron. The town does not pay for hydrants.

The population in 1880 was 3,049. The daily consumption is not known. The capital stock of the company is $10,000. The works cost $18,000. There is a debt of $1,200 at 5 per cent. interest. The expenses in 1883 were $75 and the receipts, $1,300. The officers of the company are: J. J. Williams, President; Thomas Law, Secretary; John Carroll, Treasurer and Justus Bishop, Superintendent.

DXCIII—BIRDSBORO, PA.

Birdsboro, Pa., in lat. 40° 16' 33" N. long. 78° 19' 9" W. is in a hilly country on the Schuylkill river. Settled in 1740, it was incorporated a borough in 1872. It is largely engaged in iron manufacture.

Water-works were built in 1883 by the E. & G. Brooke Iron Co., after plans of Isaac S. Cassin, C. E., taking the supply from Indian run, which drains 2½ square miles. An earth dam 30 feet high and 375 feet long with outer slope of 1½ to 1 and inner slope of 2½ to 1, paved with 12 in. scale, forms an impounding reservoir holding 40,000,000 gallons, 200 feet above the town and 2½ miles from it. The water is conveyed to the town by 12 and 10-inch pipe and distributed by 3.1 miles of cast-iron pipe of 10 to 4 in. diameter, with 50 fire hydrants and 43 gates. The works have just gone into operation and the number of taps is not given. The price to be paid by the borough for hydrants has not been determined. Service pipes are of galvanized iron.

The population is 2,200. The works cost $40,000. J. Scheible is Superintendent.

DXCIV—LONGUEUIL, QUE.

Longueuil, Quebec, in lat. 45° 40′ N. long. 73° 30′ W. is on the south shore of the River St. Lawrence, opposite Montreal. It was incorporated in 1874.

Water-works were built by the town in 1876, taking the supply from the River St. Lawrence. A 22 inch pipe conveys the water to a well 10 feet in diameter and 32 feet deep, whence it is pumped directly into the mains by steam pumps, one of 8½ in. diameter and 20 inch stroke, and one double pump of 9½ inch diameter and 18 inch stroke. The pumping machinery was constructed by the Watrous Co., of Brantford and Beauchemin of Sorel. The ordinary pressure in the mains is 30 to 40 pounds and the fire pressure 100 pounds. Distribution is by 7 miles of cast-iron pipe, of 10 to 4 inches diameter, with 39 fire hydrants, 50 gates and 500 taps. Service pipes are of lead.

The population is 2,550 and the daily consumption 115,000 gallons. The works cost $80,000. No further financial statements are given. Peter Parent is Superintendent, L. C. Bourgeois is Secretary and Treasurer of the town.

DXCV.—BRAZIL, IND.

Brazil, Indiana in lat. 39° 30′ N. long. 87° W. is in a rolling country. Settled in 1838, it was incorporated a city in 1873.

Water-works were built by the City in 1875, after plans of John McDowell, taking the supply from the ground water in a narrow valley which receives the drainage of 2 square miles. A well 18 feet in diameter and 20 feet deep was struck in a coarse sand and gravel stratum. The daily yield has been 120,000 to 140,000 gallons. In the autumn of 1883, with the view of increasing the yield, a stone dam 60 feet long and 8 feet high was built across the valley, flooding an area of 7 acres to an average depth of 5 feet, within 80 feet of the well. The water is pumped directly into the mains, by a 10 inch duplex steam pump built by Dean Brothers. The ordinary pressure is 40 lbs. and fire pressure 85 lbs. Distribution is by 3 miles of cast-iron pipe of 8 and 6 inches diameter, with 29 fire hydrants and 97 taps. Service pipes are of wrought-iron.

The population in 1880 was 3,441. The daily consumption in 1883 was 135,000 gallons. The works cost $45,000. The bonded debt is $30,000 at 8 per cent. interest. The expenses in 1883 were $2,000 and the receipts $1,600. The works are managed under the general direction of the City Council, by L. O. Schultz the Superintendent.

DXCVI.—WINNIPEG, MAN.

Winnipeg, Manitoba, in lat. 49° 58′ N. long. 97° 10′ W. on the Red River of the North and River Assiniboin is in a flat prairie country with deep alluvial soil and clay substratum, overlying limestone rock. It is 640 feet above sea level. Fort Garry was established at this point about 1820 but until 1872 the population was very small. It was incorporated a city in 1874.

Water-works were built by a private company in 1882 after plans of J. Thompson, C. E., of Glasgow, taking the supply from the River Assiniboin, which drains a territory 300 miles long. A brick tunnel 3 feet in diameter conveys the water to a pump well, whence it is pumped directly into the mains by two steam pumps each of 750,000 gallons daily capacity, constructed by R. Laidlaw & Son of Glasgow. The ordinary pressure maintained is 45 lbs. and the fire pressure 80 lbs. Distribution is by six miles of cast-iron pipes of 12 to 4 inches diameter, with 30 fire hydrants, 20 gates and 64 taps. The company furnishes water for fires gratis, in consideration of a monopoly of water supply for 20 years. Service pipes are of galvanized wrought-iron.

The first mains procured, were Scotch pipe with turned and bored joints, which did not give satisfaction, being liable to give way at the joints. Hub and spigot pipes with lead joints are now used, and are laid 8 feet under ground.

The population in 1880, was 7,985 and is now stated to be 24,000. The daily consumption is not given.

The capital stock of the company is $300,000, of which $150,000 is subscribed, and 55 per cent. of it paid up. The works have cost $130,000. The bonded debt is $60,000 at 6 per cent. So far, the expenses of maintenance have exceeded the revenue, as it is only within a few months that the citizens have begun to take water to any extent. Ledley Blanchard is President of the company and Lieut. Col. Osborne Smith, C. M. G., the Managing Director.

DXCVII.—HAGERSTOWN, MD.

Hagerstown, Maryland, in lat. 39° 45′ N. long. 77° 40′ W., is in a rolling limestone country, between the North and South Mountains of the Blue Ridge, and ¾ of a mile from Antietam Creek. It was laid out in 1762, by Capt. Jonathan Hager, and was incorporated in 1814. Water-works were built, in 1882, by the Washington County Water Company, a private corporation, after plans of Robert K. Martin, C. E., taking the supply from the headwaters of Beaver Creek on the South Mountain, 8 miles from the town. Three-quarters of a mile below the confluence of several springs, an old mill-pond is converted into a settling basin of 1,500,000 gals. content, and 150 feet from the old dam. An earth dam was built, making a reservoir of 25,000,000 gallons contents, 243 feet above the centre of the town. These reservoirs cost $14,000. The water is conveyed to the town by 7¾ miles of 12-inch cast-iron pipe laid 3 feet under ground and following the surface grade which is very irregular. There are eight gates on this main. Distribution is by 7½ miles of cast-iron pipe of 10 to 4 inches diameter, with 56 fire hydrants, 35 gates and 325 taps. There are five meters in use. Service pipes are of 1½ inch cast-iron. The town pays for hydrants.

The population, in 1880, was 6,627, and is now stated to be 10,000. There is no record of the daily consumption.

The capital stock of the company is $80,000. The works have cost $123,000. The bonded debt is $40,000 at 5 per cent. The expenses for the year 1883-4 are $1,000 and the receipts, including the stipend from the town, $9,000. William J. Hamilton is the President, and Edward W. Mealey, Treasurer of the company, and Edward Updegraff, Clerk.

CORRECTIONS.

FREDERICTON, N. B., Jan. 26, p. 45.—Full statistics of these works have been received from Alex. Burchill, Supt. There are 9¼ miles of distributing pipe, with 80 fire hydrants, 102 gates and 202 taps. Service pipes are of enameled wrought-iron. The conduit from the filter crib to the pump well is of riveted wrought-iron. The bonded debt is $200,000 at 5 per cent. The works are managed by a committee of City Council.

WATER.

THE Fourteenth Annual Report of the New Bedford Water Board has been received and will be noticed in its place in our Water Statistics.

THE Water-works Committee of the Joliet City Council, consisting of Mayor Kelly, Ald. Knox, Lagger, Donahoe, Gorman, and Chief-of-Police Paige, have been off on a tour of inspection of the works at Rock Island, Davenport, Rockford and other prominent towns, with a view of adopting some plan of water-works for that city. The construction Committee of the new court-house issued advertisements last Monday, asking for bids for the construction of the building.

THE stockholders of the Columbus, Ga., Water-Works Company, a majority of whom live in Camden, N. J., met in that city last week and elected B. D. Archer, president; John B. Whitney and F. W. Sinot, vice presidents; George W. Bailey, treasurer and Jacob H. Yocum, secretary.

HOUSE bill to incorporate the Dayton and Bellevue Water Company, with amendment, passed the Kentucky Senate on the 14th.

THE bill authorizing Hamilton, O., to issue $50,000 more of Water-works bonds passed the Senate on the 15th and became a law.

THE Insurance Companies of St. Louis, Mo., threaten to raise their rates from 10 to 200 per cent. unless a better water supply is provided.

THE bill to authorize the city of Fredericksburg, Va. to borrow money and issue and negotiate bonds to the extent of $60,000 for the purpose of supplying said city with a suitable and adequate supply of water has become a law.

THE Council Bluffs Water-works were again successfully tested on Feb. 16, and according to the report given, the satisfaction was even greater than that expressed in the report referred to in ENGINEERING NEWS, of December 15, 1883.

DEAN BROS., of Indianapolis, Ind., have recently furnished a complete set of Water-works for a large Lumber Company at Eau Claire, Wis.; also a large pump for the Clarksville (Tenn.) Water-works; also a set of vertical pumping machinery for the Citico Furnace, Chattanooga, Tenn. Capacity, one million gallons per 24-hours.

GEO. S. KEITH, C. E., of Olean, N. Y., has been appointed Chief Engineer of the Bradford, Pa., Water-works. The Company will build a dam and conduct the water to a reservoir 4¼ miles from the city and thence by a 14-inch pipe to the city.

THE bad condition of the water-mains of the old sections of the city, which was disastrously demonstrated at the Tenth Ward fire on Saturday, where thousands of dollars' worth of property was burned through the inability of the firemen to get water, was brought to the attention of the Board of Trade, at its meeting at the Mercantile Library the other evening. Without discussion a resolution was passed instructing the Committee of the Month, composed of Messrs. Andrew Wheeler Edw'd K. Stevenson and Jas Spear, to thoroughly investigate the subject, to report on whether there was considerable territory over which the danger extended and to confer with Chief Ludlow, of the Water Department, as to possible remedies. They were also requested to invite Colonel Ludlow to deliver an address before the Board, in which the matter would be fully treated, and, above all, to give information as to whether some plan could be immediately devised to diminish the risk from defective service.—*Phila. Press.*

Two of the three Worthington engines ordered by the Philadelphia Water Department, have arrived. They each have a pumping capacity of 15,000,000 gallons daily.

THE Village Board of Trustees of Hyde Park, Ills., have authorized John A. Cole, Engineer, to employ two engineers to consult with him in regard to the water-tunnel and the best plan for the further prosecution of the work.

THE city of Boston public park and water 4 per cent. loan, amounting to $950,000, to run for a period of 30 years, has been awarded to the Provident Institution for Savings, at 109.03. The $500,000 4 per cent. loan, for a period of 20 years on account of improved sewerage, has been awarded to the same institution at 107.21.

JOSEPH P. DAVIS, Mem. Am. Soc. C. E., formerly City Engineer of Boston, is Consulting Engineer for the new Broton aqueduct, and Mr. A. Fteley, formerly Resident Engineer of Additional water supply for Boston, and now Principal Assistant City Engineer of Boston, has been appointed Principal Assistant of the new aqueduct, with office in Tribune Building, N. Y. Chief Engineer Church has been very fortunate in securing the services of two such able and experienced engineers with whom to advise in the great undertaking under his supervision.

SENATE bill incorporating the Lexington Hydraulic and Manufacturing Company, passed the Kentucky Legislature on the 18th.

FOUR hundred and sixty feet of the Lynn, Mass., water-works tunnel have been excavated, and 385 feet have been finished. The progress made last week was 72 feet, and of finished work 337 feet.

IN the Massachusetts Legislature, this week, the Mansfield Pond Aqueduct Company is applying for incorporation.

HOUSE bill to incorporate the Hyde Park, Mass., Water Company is recommitted to the Committee on Water Supply.

THE Committee on Water Supply heard the petition of the city of Malden, Mass. that it may increase its water debt of $350,000 by adding $50,000 to it, for the purpose of laying a new main pipe. Hon. Lorin L. Fuller, Mayor of the city, Jerome H. Fiske, Esq., its Solicitor, Mr. Wm. F. Chester and others of its Water Board, presented the case, to which there was no opposition. The committee also heard the petition of Webster S. Wales and others of Abington, that they may be incorporated as a company to supply said town with water for domestic and other uses, the town to have the privilege to acquire all the rights and powers of the corporation. This action is taken in anticipation of the March town meeting, at which it is expected that a vote to secure a water supply will be passed. No one objected to granting the plea of the petitioners.

BY the bursting of a dam on the Los Angeles River in California, Sunday night, forty buildings were swept away and $200,000 worth of property destroyed.

THE STANTON MINE FLOOD.—WILKESBARRE, Feb. 20.—Four hundred and fifty men and boys were thrown out of work this morning by the flooding of the Stanton Mine of the Philadelphia and Reading Company. In wet weather the inflow of water is very great, and for

some days only half of the mine has been working Last night the water rose very rapidly, and this morning the mules were taken out, and the work was entirely suspended. It will take several weeks to entirely clear the mine of water.

TWO OTHER WATERY COLLIERIES.—PINE GROVE, Feb. 20.—Rausch Creek and Colket collieries, operated by the Philadelphia and Reading Coal and Iron Company, were compelled to suspend shipments yesterday on account of too much water in the mines. About 800 men and boys are temporarily idle.

HEALTH OF CITIES.—Longlevity and premature decay are doubtless influenced by the food and general habits af the people, and by temperature and other local atmospheric conditions, although all these may be largely modified and brought under control by attention to sanitary laws and appliances. Artificial atmospheres are, in fact, created in large cities according to the character of the buildings, the air space allotted to them to each inmate, and the mode of ventilation and warming, as well as by the width of the streets, the sewerage, and other sanitary arrangements. Moreover, the hereditary constitutions of the citizens become in after generations affected by the conditition of the cities in which they and their forefathers have lived.

The facts and figures before us point to many of the causes for so great a variation in the death rates as has been shown to exist in different cities. A high death rate will in most cases be found to be the companion of defective house accommodation, ventilation, water supply, sewerage, or scavenging. Thus, for instances, St. Petersburg, with a population of nearly a million, and the high death rate of 35.2 per 1,000, is without sewerage, and its water supply is taken from the river Neva, more or less contaminated by percolation from the subsoil. Cairo, with a death rate of 37 per 1,000 is supplied with water from the Nile, having no sewers, and the sewerage filtering through the subsoil into the Nile above the water intake. Vienna, with a death rate of 29.2 per 1,000, has an average of 60 people in each house, or twice as many as in Paris, while the rateable value of the houses in Vienna is only one sixth more than those in Paris. Pekin with a death rate of 50 per 1,000 is without proper sewerage, water supply, street cleansing, or other proper sanitary arrangements.

IN answer to inquiries concerning an efficient machine for tapping water, gas or steam mains under pressure, we would mention the invention of Walter S. Payne. The Philadelphia Water Department has been for some months testing machines of this description and as a result of its investigation has ordered the Payne tapping machine. It is claimed to be simple, complete and effective, tapping under 600 pounds pressure.

THE Committee on Water works of Milwaukee, Wis., have the order for a new 3,000,000 gallon pumping engine under consideration. Also, the purchase of a large lot of hydrants.

PLANS and specifications for an increased water supply for Dallas, Tex., are being prepared by Messrs. W. Sooy Smith and Chester B. Davis, Hydraulic Engineers, of Chicago, Ills. Work will commence in April and is estimated to cost $200,000.

Stand Pipes.

P. O. BOX, 35, HOUSTON, TEX. Feb. 16, 1884.

EDITOR ENGINEERING NEWS.—I desire to know if in the construction of the ordinary Stand Pipe of plate or tank iron for water-works service, say 15 or 20 feet in diameter and 100 feet high without outside masonry casing, it is ever found necessary to guy them, or are they sufficiently stable of themselves to stand without guys, and whether it is considered good practice to build them so. Also if there are many such examples of Stand Pipes so constructed, and if there is any record of any ever having given way. A reply from yourself or from any of your readers acquainted with the subject will greatly oblige SUBSCRIBER.

[When properly designed and well built, guys are unnecessary on Stand Pipes of the diameter and height mentioned. The steel Stand Pipe at Sandusky, O., is 229 ft. high and 25 ft. in diameter, including a masonry base about 30 ft. high. A Stand Pipe in Philadelphia is about 130 ft. high and 6 ft. in diameter; both of these are self-supporting. We know of no cases of failure.—ED. ENG. NEWS.]

WANTED—STATISTICS.

The historical sketches and descriptions of the water-works of six towns which we publish this week, embrace a variety of methods of supply, and are fair specimens of the information contained in the valuable work which has been continued in our columns for nearly three years and is now approaching completion. The labor of collecting statistics from the 597 towns whose works have been described, has been enormous. Why the officers of many works neglect to reply to the letters sent them, we cannot understand. Within the last nine months every known water-works has been sent a copy of the "Statistical Tables" giving more information than has ever been heretofore collected regarding American water-works, and since February 1, every secretary of a water board or company, which has not sent data, has been directly solicited by letter with a blank and a stamped envelope for reply enclosed. About 25 per cent. only have replied up to this time. But among those which have not responded are Mobile, Ala., Newburyport, Mass., Canton, O., Austin, Tex., Chillicothe, O., Shenandoah, Pa., Columbia, S. C., Knoxville, Tenn., Jeffersonville, Ind., Elgin and Ottawa, Ill., Danville, Va. and Michigan City, Ind.

We propose to make our Water "Department" even more complete and valuable than we have ever yet done. Especial attention will be given to the collection of news relating to water-works, old or new; whatever pertains to the subject we will publish, and we especially solicit the active co-operation of our subscribers and advertisers. Send along notes of anything that is of interest; if occasional advertising is enclosed in the item it is all right; it is welcome as news when it comes from parties represented in our advertising pages whom we are always pleased to serve as well as we can. If you see a local paper with an item referring to water-works in it, do us the favor of sending it as soon as possible. We like to receive marked papers, as it is quite out of the question for us to take all that are published in this broad country of ours.

NEWS OF THE WEEK.

Railroads.

TWENTY billion dollars are invested in railroads in the two hemispheres.

THE Franklin branch of the Virginia Midland road is to be changed from the narrow to the standard gauge.

A NEW road, narrow gauge, is projected from Lake de Funiak, Florida, to Montgomery, Alabama, to be built by the Standard Oil Company.

THE Louisville & Nashville will build a branch road to connect their system with the navy Yard at Pensacola, to transport coal and iron direct from Birmingham for government use.

VILLARD, late President of the Northern Pacific, is mentioned in connection with a railroad enterprise from St. Andrews' Bay, West Florida, to connect with the Pensacola & Atlantic road.

MR. EDMUND LANE, Superintendent of bridges and buildings for the Union Pacific, has received instructions to proceed at once to get in readiness for erecting the new Union Pacific headquarters building at Omaha.

A NEW line which will open up valuable timber and cotton regions in Missouri and Arkansas is under consideration. It will run from Point Pleasant, New Madrid county, Missouri, to Minturn, Arkansas, forming a junction with the Iron Mountain road at Minturn.

THE best results with an electric locomotive show that one of two tons weight will carry fifteen tons eight miles an hour. The engine was a twenty-five horse power, and ran one mile over heavy grades and around sharp curves.

THE Lehigh Valley Road is building a locomotive at Wilksbarre, Penn., which is said to be the heaviest in the State. It will have ten driving wheels, with pony trucks before and behind.

AN official circular from the City of Mexico announces that only 75 miles of rails remain to be laid on Mexican Central Railroad, and that the road will be completed by March 15, when there will be an international route from the Missouri to the Mexican capital, a distance of 1,540 miles.

SENATE bill to incorporate the Lynchburg and Southwestern Railroad Company. Also the bill to incorporate the Salem and Southwestern Railroad Company, with House amendments passed the Virginia Legislature last week.

A COMPANY is being organized to build a railroad from Brunswick, Georgia, to Cape Sable, Florida, to run in connection with a line of steamers from there to Havana, thus making the trip from New York to Havana in about three days. The road will also have good connections from Brunswick west and northwest.

THE Moline, Rock Island & Southern Railway has been licensed to incorporate. The object is to construct a line from Rock Island to Peoria through the counties of Rock Island, Mercer, Warren, Knox, and Peoria, with the principal office at Rock Island. The capital stock is $1,000,000. The Directors are Charles H. Deere, John M. Gould, H. A. Ainsworth and S. W. Wheelock, all of Moline; P. L. Mitchell and A. C. Dast, of Rock Island; and James T. Hane and W. C. Wansworth, of Davenport.

A CHARTER has been issued to the Kanawha Valley Railroad Company of West Virginia, with $3,000,000 capital, to construct a road through Wood and West counties, passing near Wirt Courthouse, thence by the most practical route to a point near Spencer, Roane county, thence by the most expeditious route through the counties of Calhoun and Gilmer, by way of Glenville, to Weston, Lewis county.

HIS ABILITY RECOGNIZED.—"So you want a situation as conductor, do you?" said the President of ths road.

"Yes, sir," the applicant replied.

"Have you the necessary qualifications for such a responsible position?"

"Yes."

"Well, suppose your train should meet with a serious disaster, in which a number of passengers would be killed and a large amount of property be destroyed, what action would you take in such a case?"

"I would telegraph to the newspapers that the accident was of little importance, and then send word to the President of the road to sell the stock short."

"H'm." replied the President, "I am afraid those are not the proper qualifications for a good conductor, but you are a man of ability, I see. We want a first-class superintendent. You can consider yourself engaged as superintendent of the road at a salary of $10,000 a year."—*Phila. Call.*

CHICAGO & NORFOLK AIR LINE.—The latest advices from New York City confirm the report that the line proposed between Chicago and Norfolk, Va., is to be built. A leading broker says: The Chicago and Norfolk Air Line is a fixed fact, and it is only a matter of time when the proposed scheme will become an active competitor. Already the field has been surveyed (Virginia and Ohio especially), with a view to determining the latest and best route and at the same time locating the line so that Columbus (Ohio) and Parkersburg (W. Va.) will be in a direct air line, and the distance between those points shortened about forty-five miles.

The line will have either one or two branches, viz.: from Columbus to Cincinnati and from Staunton, Va., to Washington, D. C., and perhaps an extension of the latter branch to Baltimore, where it will have the choice of lines to New York, or water to all points East.

Should the line be completed as proposed, it will be a direct competitor to all the trunk lines out of Chicago, and a rival the Baltimore & Ohio and the Chesapeake & Ohio must feel, since at Cincinnati and Norfolk, the latter company's terminals, will be tapped, while the Baltimore & Ohio will have a lively competitor at and between Baltimore, Washington. Parkersburg, Columbus and Chicago.

"The enterprise is entirely foreign. The capital is to be furnished by Danish and English capitalists backed by a few well-known Americans, mostly New Yorkers and members of the Stock Exchange. The line between Cbicago and Norfolk will probably be 825 or 850 miles long, and less if possible. When matters are arranged so estimates can be given and the location given, a charter will be applied for and operations begun." New York capitalists have been looking into the scheme.

TORONTO, Ontario, Feb. 17.—The Gananoque, Perth and James Bay Railway Company has been formed, for the purpose of building a line from some point at or near Gananoque to Perth, and thence to some point on James Bay, and branches to connect with other lines and with the bodies of water. The present capital stock is $1,000,000.

A VERDICT AGAINST READING.—On January 23, 1880, Clark, Post & Martin, of New York, made a contract with the Phila. and Reading Coal and Iron Company, to deliver 5,000 tons old iron "T" rails at $43.50 per ton if delivered in Philadelphia, and $1 less if delivered in New York. Shipments were to be made from foreign ports in the months of February, March, April, May and June of about 1,000 per month, and payments were to be made in cash on the presentation of invoices and United States weighmaster's return.

Soon after this contract was made the company became very hard up for rails, and, in response to its urgent demand, a shipment was made of par of the rails in advance of the stipulated time.

The company went into the hands of receivers on May 21, 1880, and default was made in payment for the rails shipped under the agreement. The receivers refused to take any more rails under the contract, and made a rather vague claim of a non-fulfillment on its terms on the part of Clark, Post & Martin. The shipments continued until June. The rails remained on the hands of that firm until February, 1881, when they were sold to the receivers of the Coal and Iron Company at a loss of $70,000 to the firm. For this sum they brought suit in Common Please No. 4. On the trial of the case Judge Elcock harged that, if certain

of the rails were shipped in months earlier than those specified in the agreement, but in response to earnest requsts for haste on the part of the company, the company was not now at liberty to object to the date of such shipments. The jury found a verdict of $70,027.26 in favor of the plaintiffs. The principal assignment of error in the Supreme Court was Judge Elcock's instruction to the jury. The Court, however, in a *per curiam* opinion, affirmed the judgment and find no error in the law as laid down by him.

PRESIDENT COLBY, of the Wisconsin Central Railroad, has succeeded in raising at Boston, $2,500,000 for building the line between Chippewa Falls and St. Paul.

THE extension of the Waterloo & Magog Railway of Canada, connecting Sherbrooke and Magog, was formally opened and inspected by the government engineer, Mr. L. A. Vallée, on the 13th instant. Messrs. Bowen and Woodward were the contractors, and Mr. W. T. Pierce the engineer.

THE La Crosse, Iowa & Southwestern company are getting right down to business at last, and confidence has been fully restored by the acts of its managers within the past few days. The most important action yet taken was the appointment of the well-known civil engineer, Mr. M. J. McCabe, engineer in chief, with instructions to organize his corps immediately. Mr. McCabe is an engineer of acknowledged ability, having served with distinction in the construction of the Pan Handle, Toledo, Wabash & Western, Des Moines Valley, Hannibal & St. Joseph and the Kansas City, St. Joseph & Council Bluffs. Besides this he served as city engineer of the city of St. Joseph for eight years.—*St. Joseph (Mo.) Gazette.*

GALVESTON, TEXAS, February 17.—Hunter, Sampsel and Wells, the contractors who graded the International and Great Northern Railroad extension a hundred miles into Mexico, have procured a judgment against the construction in Mexico, for $234,900. The entire road-bed and its fixtures will be sold within twenty days to satisfy the judgment. It is reported on reliable authority that the outfit of mules, scrapers and equipage of the construction company will be seized by the Mexican Custom-house authorities to pay customs and dues owned by the Gould combination for railroad supplies introduced at different times into Mexico during the construction of the road.

Bridges.

THE following are the bids for the 15th Street Bridge, Denver, Colo., submitted to the City Council, last week:

King Iron Bridge and Manufacturing Company, Cleveland, O., 26 feet, $16,300; 30 feet, $17,000.

Smith Bridge Company, Toledo, O., 26 feet, $15,900; 30 feet, $16,800.

Missouri Valley Bridge and Iron Works, Leavenworth, Kan., 26 feet, $15,700; 30 feet, $16,800.

Canton Wrought Iron Bridge Company, Canton, O., 26 feet, $15,675; 30 feet, $16,684.

Morse Bridge Company, Athens, O., 26 feet, $15,600.

Kansas City Bridge and Iron Company, 26 feet, $15,490; 30 feet, $16,400.

Raymond & Campbell, Council Bluffs, Ia., 26 feet, $15,100; 30 feet, $16,100.

The following resolution was submitted by Alderman Brooks, and adopted:

Resolved, That the Council proceed to make an award for the construction of the superstructure of the 15th Street bridge, the award to be conditional upon their being a sufficient sum of money to the credit of streets, alleys and bridges on the 1st day of May, 1884, to pay the amount stipulated.

Alderman Fox moved that the contract for the construction of the bridge be awarded to Messrs. Raymond & Campbell.

Alderman McGilvrey suggested that the gentlemen would not accept the contract under the conditions.

Alderman Darrow said that the Council should not overlook the fact that it was possible for iron to decline at the end of three months.

Alderman McGilvray commended to the Council the propriety of estimating the weight of the iron to be employed in the bridge and to arrange for any fluctuation of prices at the time of the letting of the contract and at the time for its execution.

On motion the further consideration of the matter was deferred for the purpose of allowing the bidders to make calculations as to the amount of iron involved and to provide for the rise or decline of the material.

BILLS have been introduced into the Virginia Legislature to incorporate the New Garden Bridge Company, in Russell County, Va., also to incorporate the Jessie's-Mill Creek Bridge Company, in Russell County, Va.

A COMPANY has been organized, with a capital of $1,000,000, to construct a second railroad bridge over the Mississippi from Rock Island to Davenport. The incorporators are 13 of the leading business men of Davenport, Rock Island and Moline.

RICH HILL, Kan., Feb. 12.—The township board met to-day to receive the report of Road Commissioner Wolfe, appointed to survey the road from the new bridge to the town. The report also contained an estimate of an 120 feet span iron bridge over Slough branch.

Streets, Sewerage and Drainage.

STAMFORD, CONN., is to have a system of sewerage costing $100,000.

SOME time ago a sewer at New London, Conn. burst, causing a foul condition of things. Upon investigation it was found that a root from a large elm tree had worked through the pipe, and in its growth had torn the pipe to pieces and blocked up the sewer.

PHILADELPHIA, PA., Feb. 15.—The City Controller, to-day, returned the street-cleaning warrants without his signature. In a letter giving his reasons for this course he declares that the streets are a disgrace to the city and dangerous to health of the people.

CEMETERY DIRECTOR—"The lots do not seem to be going off very fast." Superintendent—"No; sales have been awfully slow." Director—"Cannot something be done to hurry up the business a little?" Superintendent—"It would not do to change our regular prices." Director—"But there must be some way to get around that. Can't we have a special sale of some kind?" Superintendent—"I have it! We'll offer some big bargains in misfit graves."—*Phila. Call.*

BOOKS about sanitary matters are beginning to appear with such frequency that it is evident the public are rapidly awakening to the importance of the subject. The latest manual on the subject is a little hand-book of "Sanitary Information for Housekeepers," which contains brief and sensible suggestions and facts about ventilation, drainage, care of contagious diseases, disinfection, food and water, together with appendices on disinfectants and plumbers' materials. It is from the pen of Roger S. Tracy, M. D., the Sanitary Inspector of New York City Health Department, (110 pp., cloth; index. New York: D. Appleton & Co.) Another volume entitled "Health at Home," by A. H. Guernsey and Irenæus P. Davis, M. D., covers somewhat the same ground, but also includes hints as to clothing and food. It is a very useful little manual, and is one of the most important issues in the series of Appleton's Home Books. (155 pp., cloth; 60 cents).

Gas and Electricity.

THE certificate of incorporation of the American Electric Transportation Company was filed in the County Clerk's office recently. The company will manufacture materials for street railroads and machinery to propel cars by electricity. Its capital stock is $1,000,000, divided into 20,000 shares of $50 each. Its incorporators are Rolla E. Brewster, Brooklyn; Frank S. Davis, Memphis, Tenn., and Alfred A. Marsh, William Myers, and Cornelius S. Groot, New York.

GEORGE WADSWORTH, Electrician: There is nothing at present known that can displace the carbon in electric lights. The carbons for the voltaic are system are mostly made at Cleveland, and cost $50 a thousand. For the incandescent light carbonized bamboo, linen thread, and cardboard are used. The base of the Cleveland carbons is petroleum coke. It is ground fine, then mixed and pressed under heavy hydraulic presses to give it adhesiveness. The process is partly a secret one.

ARTICLES of incorporation of the Central Pueblo, Colo., Gaslight company, capital stock, $25,000, were filed with the Secretary of State last week. Henry Ropes, B. J. McCabe and A. A. Groome are the directors.

A BOOM is also being started in electric-light matters in Joliet, Ills. Two companies are in the field. S. S. Badger, of Chicago, has acquired the franchise of the Joliet Electric-Light Company, and is actively engaged in putting in his plant—the Fuller system. He proposes to place the lamps in all the prominent stores on thirty days' trial free of charge. The Citizens' Electric-Light Company, which is backed by Mr. H. B. Scott, will also put in a plant of the Van Deopoele Company. He has contracted for sixty lamps as a starter.

IRON, METAL AND COAL MARKETS.

PHILADELPHIA, Feb. 21, 1884.

To-day's quotations in Iron and Steel are, $20@$21.50 for No. 1 Foundry, $19@$20 for No. 2, $17.50@$18.50 for Forge, with average sales at $20.50, $19 and $18 respectively: Bessemer Iron, $20@$21; Spiegeleisen, $28@$29; Muck Bar, $32@33, according to make; Blooms, $45 for Anthracite, and $56 for charcoal; merchant iron, 1.70@2.10, according to size and quality of order, as well as location of mill. Nails, $2.50@$2.60; Old Rails, $23@$23.50 for tees; Plate Iron, 2.20 for common; Beams and Channels, 3.50. The volume of business has been rather disappointing to some, but has been, on the whole, fair, and there are inquiries now in hand which indicate that the spring orders will soon come along and be of large proportions. There have been offers for small lots of Steel Rails at $34, but these have been refused, only large orders being accepted in eastern Pennsylvania mills at that figure. A few small lots have been ordered at $35, and makers say that these figures are the best that they will name for large and small lots, although buyers are confident that they can buy at their own terms, as soon as some of the contracts now in hand are executed, and the mills are a little more anxious to secure business. Some good brands of Forge Iron, heretofore held firmly at $18, have been sold during the past week at $17.50, but as a general thing the prices are held to and the tone of the market is strong. Merchant Bar is in active request, though no large transactions are reported. Best refined has sold at 2.10 from store, but most of the sales are at 1.90 to 2.05. Common has been freely offered in country mills, at about 1.70 and the mills are still slowly increasing their output. Old Rails, Bessemer Pig and Spiegeleisen are wanted in large lots, but prices are held far above buyers views, and hence transactions are insignificant.

PITTSBURGH, Feb. 21, 1884.

Everything has been dull for the past week, as business has been seriously interfered with by the flood. A large number of mills and foundries have been considerably damaged, and although the danger now seems to be over, it will be some time before the damages can be repaired and all the works start up again. Pig Iron has been in fair request at $18@$21 for Foundry, $17@$18 for Mill Irons, $32 for Muck Bar, with no demand. The Nail manufacturers have reduced the card to $2.60; most of the mills are at work, or will be in a few days. Demand is only moderate. Merchant Iron is rather stronger, and is selling in small lots at 1.70@1.90. Steel Rails are quoted at $35@$36, and no large orders are reported. Bessemer Pig, $21@$21.50. All the window glass works have started up; the strike of the green glass workers continues. The miners of the third pool on the Monongahela River are out on a strike.

CHICAGO, Feb. 20, 1884.

There are no marked changes to report in the iron trade of this section. Prices are fairly maintained, and inquiry is active, but orders are for small lots, and manufacturers are still looking forward with great anxiety to the presentation of the spring requirements. Bar Iron is moving slowly, and in trifling lots, but prices are steady at about $1.90 for common and $2.00 for refined, with concessions for large orders. Plate and Sheet Iron are in moderate demand, but only current requirements are provided for; Quotations are shaded from the following figures: 2.50@2.60 for Tank, 2.70 for Angles, 3.50 for Beams, 3.80 for Channels, etc. Galvanized Iron is in good request, and manufacturers are well employed, but prices are as heretofore quoted. Norway, Swedish, and Russia Irons are dull and weak. Ulster Iron is steady at 3¾ and is moving in small lots. The Steel trade is more active, and small lots have been moving at rather stronger prices, though quotations are unchanged. Pig Iron is moderate request. Southern irons and lake charcoal are in active demand. Several large contracts for Southern Iron are in negotiation; prices are unchanged. Very little is being done in ores, and the market is very quiet. Nails are being offered rather more freely and prices are being cut more than usual; car load lots $2.50 with small lots 10c. higher.

COAL.

PHILADELPHIA, Feb. 21, 1884.

Instead of returning full time, in order to meet the market requirements, as was thought would be necessary, a few weeks ago, the Anthracite companies now find it difficult to dispose of the half time production, and stocks are increasing at all shipping ports; Port Richmond stocks being to-day in the neighborhood of 160,000 tons. Production for last week, 480,000 tons. The local trade is less active than last week, and the line trade is not taking as much as was expected. Coastwise freights have declined rapidly during the past week, but buyers are not taking much advantage of the fact. Inquiries from the West are active, but no large orders have been placed. The Bituminous trade is in a rather more hopeful condition, owing to the placing of several large contracts, and the prospects for placing more at an early date. The Cumberland region is being worked one-third, and the Clearfield region, one-half time. Prices are very low. Freight rates have not yet been fixed. A large amount of demand is still being withheld, in the hope of a weakness in prices, but any great weakness is improbable, although some shading will probably result from the present accumulation of stocks, and dull demand.